**Karan Arora**  **R.L. Institute M: 9416974837**

**Assignment – I**

1. 200 mL of a gas are found to have a pressure of 750 mm. What will be its volume if the pressure is doubled at the same temperature?
2. A balloon filled with a ideal gas is taken from the surface of sea deep to a depth of 100m. What will be its volume in terms of its original volume?
3. A bulb ‘X’ of unknown volume containing a gas at one atmospheric pressure is connected to an evacuated bulb of 0.5 litre capacity through a stopcock. On opening the stopcock, the pressure in the whole system after some time was found to have a constant value of 570mm at the same temperature. What is the volume of the bulb X ?
4. A gas occupies a volume of 2.5 L at 9 x 105 N m­-2. Calculate the additional pressure required to decrease the volume of the gas to 1.5 L, keeping the temperature constant.
5. At what temperature centigrade will the volume of a gas at 0˚C double itself, pressure remaining constant?
6. A 10 litre container is filled with a gas to a pressure of 2 atm at 0˚C. At what temperature will the pressure inside the container be 2.50 atm?
7. An open vessel contains 200mg of air at 17˚C. What weight percent of air would be expelled if the vessel is heated to 117˚C?
8. 300ml of oxygen gas at - 10˚C are heated to 10˚C. what is the new volume if pressure remains constant?
9. 25 dm3 of ammonia at 283 K are heated until its volume is 30 dm3. To what temperature must it have been raised to accomplish the change?
10. What volume of air will be expelled from a vessel containing 400cm3 at 7˚C when it is heated to 27˚C at the same pressure?
11. A steel tank containing at 15 atm pressure at 15˚C is provided with a safety value that will yield at a pressure of 30 atm. To what minimum temperature must the air be heated to blow the safety valve?
12. It is desired to increase the volume of a gas by 20% without changing the pressure. To what temperature, the gas must be heated if the initial temperature of the gas is 27˚C?
13. A gas cylinder containing cooking gas can withstand a pressure of 14.9 atmospheres. The pressure gauge of the cylinder indicates 12 atmosphere at 27˚C. Due to sudden fire in the building, the temperature starts raising. At what temperature the cylinder will explode?
14. On a ship sailing in pacific ocean where temperature is 23.4˚C, a balloon is filled with 2 L air. What will be the volume of the balloon when the ship reaches Indian ocean where temperature is 26.1˚C?
15. A vessel of 120 mL capacity contains a certain mass of a gas at 20˚C and 750 mm pressure. The gas was transferred to a vessel whose volume is 180 mL. Calculate the pressure of the gas at 20˚C.
16. 103 mL of carbon dioxide were collected at 27˚C and 763 mm pressure. What will be its volume if the pressure is changed to 721 mm at the same temperature ?

**Answers**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1. 100 mL | 2. 9.3 % | 3. 1.5 L | 4. 6 x 105 Nm-2 | 5. 273˚C | 6. 68˚C |
| 7. 25.37 % | 8. 322.8 mL | 9. 339.6 K | 10. 28.6 cm3 | 11. 303˚C | 12. 87˚C |
| 13. 99.5˚C | 14. 2.018 L | 15. 500 mm | 16. 109 mL |  |  |

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**Assignment – II**

1. At 27˚C and 1 atmospheric pressure, a gas has volume V. What will be its volume at 177˚C and a pressure of 1.5 atmosphere?
2. A sealed tube which can withstand a pressure of 3 atmospheres is filled with air at 27˚C and 760 mm pressure. Find the temperature above which it will burst.
3. 400ml of oxygen at 27˚C were cooled to – 15˚C without the change in pressure. Calculate the contraction in volume.
4. A volume of hydrogen measures one cubic decimeter at 20˚C and at a pressure of half an atmosphere. What will be its volume at 10˚C and at 700 mm pressure?
5. 300 litres of ammonia gas at 20˚C and 20 atmosphere pressure are allowed to expand in a space of 600 litres capacity and to a pressure of 1 atmosphere. Calculate the drop in temperature.
6. One litre flask containing vapours of methyl alcohol ( Mol mass = 32 ) at pressure of 1 atm and 25˚C was evacuated till the final pressure was 10-3mm. How many molecules of methyl alcohol were left in the flask?
7. Temperature at the foot of the mountain is 30˚C and pressure is 760 mm whereas at the top of the mountain these are 0˚C and 710 mm. Compare the densities of the air at the foot and at the top of the mountain.
8. At 25˚C and 760 mm of Hg pressure, a gas occupies 600 mL volume. What will be its pressure at a height where temperature is 10˚C and volume of the gas is 640 mL?
9. 10g of O2 were introduced into a evacuated vessel of 5 litres capacity maintained at 27˚C. Calculate the pressure of the gas in atmospheres in the container.
10. Calculate the temperature at which 28g of N2 will occupy a volume of 10 litres at 2.46 atmosphere.
11. 2.802g of N2 gas is kept in a litre flask at 0˚C. Calculate the pressure exerted by the gas.
12. Calculate the molar volume of a gas at STP .
13. A 500 ml sample of a gas weighs 0.326g at 100˚C and 0.5 atm. What is the molecular mass of the gas?
14. A large flask fitted with a Stop-cock is evacuated and weighed; its mass is found to be 134.567g. If is then filled to a pressure of 735 mm at 31˚C with a gas of unknown molecular mass and then reweighed; its mass is 137.456g. The flask is then filled with water and weighed again; its mass is now 1067.9g. Assuming that the gas is ideal, calculate the molar mass of the gas.
15. The density of a gas is found to be 1.56g/litre at 745 mm pressure and 65˚C. Calculate the molecular mass of the gas.
16. The density of a gas 3.80 g L-1 at STP. Calculate the density at 27˚C and 700 torr pressure.
17. The density of a gas found to be 3.43g/litre at 300 K and 1 atm pressure. Calculate the molar mass of the gas.
18. If the density of a gas at the sea level at 0˚C is 1.29 Kg m-3, what will be its molar mass (Assume that pressure is equal to 1 bar).
19. At 0˚C, the density of a gaseous oxide at 2 bar is same as that of nitrogen at 5 bar. What is the molecular mass of the oxide.

**Answers**

1. “V” 2. 627˚C 3. 56 mL 4. 0.524 dm3 5. 263.7 K

6. 3.24 x 1016 7. 0.964 : 1 8. 676.6 mm Hg 9. 1.54 atm 10. 299.6 K

11. 2.24 atm 12. 22.4 L 13. 39.9 amu 14. 80.25 g/mole 15. 44.2 g/mole

16. 3.18 g/L 17. 84.5 g/mole 18. 29.3 g/mole 19. 70 g/mole

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**Karan Arora** **M:9416974837**

**Assignment – III**

1. Pressure of 1 g of an ideal gas A at 27˚C is found to be 2 bar. When 2 g of another ideal gas B is introduced in the same flask at same temperature, the pressure becomes 3 bar. Find the relationship between their molecular masses.
2. What will be the pressure exerted by a mixture of 3.2 g of methane and 4.4 g of carbon dioxide contained in a 9 dm3 flask at 27˚C?
3. 34.05 mL of phosphorus vapour weigh 0.0625 g at 546˚C and 1 bar pressure. What is the molar mass of phosphorus?
4. A student forget to add the reaction mixture to the round bottomed flask at 27˚C but instead, he placed the flask on the flame. After a lapse of time, he realized his mistake, and using a pyrometer, he found the temperature of the flask was 477˚C. What fraction of air would have been expelled out?
5. Calculate the total pressure in a mixture of 8 g of oxygen and 4 g of hydrogen confined in a vessel of 1 dm3 at 27˚C. R = 0.083 bar dm3 K-1 mol-1.
6. 2.9 g of a gas at 95˚C occupied the same volume as 0.184 g of hydrogen at 17˚C at the same pressure. What is the molar mass of the gas?
7. A spherical balloon of 21 cm diameter is to be filled with hydrogen at NTP from a cylinder containing the

gas at 20 atmosphere at 27˚C. If the cylinder can hold 2.82 litres of water, calculate the number of balloons that can be filled up.

1. An iron cylinder contains helium at a pressure of 250 kPa at 300 K. The cylinder can withstand a pressure of 1 x 106 Pa. The room in which cylinder is placed catches fire. Predict whether the cylinder will blow up before its melt or not. (M. P. of the cylinder = 1800 K)
2. An evacuated glass vessel weights 50 g when empty, 148 g when filled with a liquid of density 0.98 g/mL and 50.5 g when filled with an ideal gas at 760 mm Hg at 300 K. Determine the molecular weight of the gas?
3. The pressure exerted by 12 g of an ideal gas at temperature t˚C in a vessel of volume V litre is one atm. When the temperature is increased by 10 degrees at the same volume, the pressure increases by 10%. Calculate the temperature t and volume V(Molecular weight of gas = 120)

**Answers**

1. MB = 4 MA 2. 0.82 atm 3. 125 g/mole 4. 3/5 5. 56 bar

6. 40 g/mole 7. 10 8. It will blow 9. 123 g/mole 10. 0.82 L

**Assignment – IV**

1. 38 mL of most nitrogen gas were collected at 27˚C and 746.5 mm pressure. Calculate the volume of the gas at 0˚C and 760 mm pressure. (Aq. Tension at 27˚C is 26.5 mm).
2. 250 mL of nitrogen maintained at 720 mm pressure and 380 mL of oxygen maintained at 650 mm pressure are put together in one litre flask. If the temperature is kept constant, what will be the final pressure of the mixture?
3. A given mass of a gas occupies 919 mL in dry state at STP. The same mass when collected over water at 15˚C and 750 mm pressure occupies one litre volume. Calculate the vapour pressure of water at 15˚C.

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1. A 2 L flask contains 1.6 g of methane and 0.5 g of hydrogen at 27˚C. Calculate the partial pressure of each gas in the mixture and hence calculate the total pressure.
2. A gaseous mixture contains 56 g N2, 44 g CO2 and 16 g CH4. The total pressure of the mixture is 720 mm Hg. What is the partial pressure of CH4?
3. 200 mL of hydrogen and 250 ml of nitrogen each measured at 15˚C and 760 mm pressure are put together in a 500 mL flask. What will be the final pressure of the mixture at 15˚C?
4. Two vessels of capacities 1.5 litres and 2 litres containing hydrogen gas at 750 mm pressure and oxygen at 100 mm pressure respectively are connected to each other through a valve. What will be the final pressure of the gaseous mixture assuming that temperature remains constant?
5. A neon – dioxygen mixture contains 70.6 g dioxygen and 167.5 g neon. If the pressure of the mixture of the gases in the cylinder is 25 bar, what is the partial pressure of dioxygen and neon in the mixture?
6. What will be the pressure of the gas mixture when 0.5 L of H2 at 0.8 bar and 2 L of oxygen at 0.7 bar are introduced in a 1 L vessel at 27˚C?
7. A mixture of dihydrogen and dioxygen at one bar pressure contains 20% by weight of dihydrogen. Calculate the partial pressure of dihydrogen?
8. Payload is defined as the difference between the mass of the displaced air and the mass of the balloon. Calculate the payload when a balloon of radius 10 m, mass 100 kg is filled with helium at 1.66 bar at 27˚C (Density of air = 1.2 kgm-3 and R = 0.0833 bar dm3 K-1 mol-1)
9. A balloon of diameter 20 m weighs 100 kg. Calculate its payload if it is filled with He at 1 atm and 27˚C. Density of the air is 1.2 kgm-3. (R = 0.082 dm3 atm K-1 mol-1)
10. Calculate the total pressure in a 10 L cylinder which contains 0.4 g of helium, 1.6 g of oxygen and 1.4 g of nitrogen at 27˚C. Also calculate the partial pressure of helium gas in the cylinder. Assume ideal behavior for gases.(R = 0.082 L atm K-1 mol-1)
11. A 2 L container at 25˚C contains 1.25 mol of oxygen and 3.3 mol of carbon (s).

a) What is the initial pressure in the flask?

b) If carbon and oxygen react as completely as possible to form CO, what will be the final pressure in the container?

1. A mixture of CO and CO2 is found to have a density of 1.5 g/ L at 20˚C and 740 mm pressure. Calculate the composition of the mixture?

**Answers**

1. 32.76 mL 2. 427 mm 3. 13.3 mm

4. PH2 = 3.08 atm, PCH4 = 1.23 atm, PTotal = 4.31 atm 5. 180 mm

6. 684 mm 7. Pmixture = 378.57 mm 8. PO2 = 525 bar, PNe = 19.75 bar

9. 1.8 bar 10. 0.8 bar 11. 3811.1 kg

12. 4247.2 kg 13. 0.492 atm, 0.246 atm 14. (a) 15.3 atm, (b) 30.6 atm

15. Co = 43.38% , CO2 = 56.62%

**Assignment – V**

1. If 25 mL of CO2 diffuses out of a vessel in 75 seconds, what volume SO2 would diffuse out in the same time under the same conditions?
2. Calculate the molar mass of an unknown gas which diffuses 1.117 times faster than oxygen gas through the same aperture under the same conditions of temperature and pressure.

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**Karan Arora** **M:9416974837**

1. Uranium isotopes have been separated by taking advantage of the different rates of diffusion of the two forms of uranium hexafluoride, one containing U-283 isotope and other containing U-235. What are the relative rates of diffusion of these two molecules under ideal condition?
2. A small quantity of gaseous NH3 and HBr are introduced simultaneously into the opposite ends of an open tube which is 1 m long. Calculate the distance of the white solid NH4Br formed from the end which was used to introduce NH3.
3. At room temperature ammonia gas at 1 atm pressure and HCL gas at pressure P atm are allowed to effuse through identical pin holes from opposite ends of a glass tube of 1 m length and of uniform area of cross-section. NH4Cl is first formed at a distance of 60 cm from the end through which HCL gas was sent in. Calculate the value of P.
4. A 4:1 molar mixture of He and CH4 is contained in a vessel at 20 bar pressure. Due to a hole in the vessel the gas mixture leaks out. What is the composition of the mixture effusing out initially?
5. The composition of the equilibrium mixture ( Cl2 ⇌ 2Cl ). Which is attained at 1200˚C is determined by measuring the rate of effusion through a pin-hole. It is observed that at 1.80 mm Hg pressure, the mixture effuses 1.16 times as fast as Krypton effuses under the same conditions. Calculate the fraction of chlorine molecules dissociated into atoms (Atomic weight of Kr = 84).
6. 1 mole of nitrogen gas at 0.8 atm takes 38 sec to diffuse through a pin hole whereas 1 mole of an unknown compound of Xenon with fluorine at 1.6 atm takes 57 sec to diffuse through same hole. Calculate the molecular formula of compound. ( Atomic weight of Xe =131).

**Answers**

1. 20.73 mL 2. 25.65 g/ mole 3. 0.9957 : 1 4. 68.58 cm

5. 2.19 atm 6. 8 : 1 7. 0.137 8. XeF6

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**Karan Arora M: 9416974837**

**COMPETITION FOCUS – 1**

1. Study the figures given below and identify the type of interaction between XY-XY molecules.

|  |  |
| --- | --- |
| a) Dipole-Induced dipole | b) Dipole-Dipole |
| c) Dispersion forces | d) Induced dipole-Induced dipole |

1. The type of attractive forces between a polar molecule and a non-polar molecule are

|  |  |
| --- | --- |
| a) dipole-dipole forces | b) hydrogen bonds |
| c) Dipole-Induced dipole forces | d) Dispersion forces |

1. Boiling point of hydrogen fluoride is highest amongst HF , HCl , HBr and HI. Which type of intermolecular forces are present in hydrogen fluorides ?

a) H – F has highest van der waals forces and dipole moment.

b) H – F has highest London forces.

c) H – F has highest dipole moment hence has dipole-dipole, London forces and hydrogen bonding.

d) H – F has strong intermolecular interactions like dipole-induced dipole.

1. Elements I , II , III , IV and V exist as gases under normal condition besides noble gases. The gases I , II , III , IV and V are

|  |  |  |  |
| --- | --- | --- | --- |
| 15 | 16 | 17 | 18 |
|  |  |  | He |
| II | III | IV | - |
|  |  | V | - |
|  |  |  | - |

|  |  |
| --- | --- |
| Group | 1 |
|  | I |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | I | II | III | IV | V |
| (a) | H | N | O | F | Cl |
| (b) | H | O | N | Cl | F |
| (c) | H | N | O | Cl | I |
| (d) | He | O | N | Cl | Br |

1. Which of the following does not express the properties of gases ?

a) Gases are highly compressible

b) Gases exert pressure equally in all directions

c) Gases have much higher density than liquids and solids

d) Gases mix evenly and completely in all proportions.

1. Which of the following graphs represents the correct Boyle’s law ?

P ↑ PV ↑ V ↑ P ↑

1/V → P → P → 1/V →

(i) (ii) (iii) (iv)

|  |  |  |  |
| --- | --- | --- | --- |
| a) (i) , (ii) and (iii) | b) (i) and (iv) | c) (ii) and (iii) | d) (i) , (ii) and (iv) |

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1. Representing P,V and T as pressure, volume and temperature, which of the following is the correct representation of Boyle’s law ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) V (P constant) | b) V (T constant) | c) PV = RT | d) PV = nRT |

1. Graphs between pressure and volume are plotted at different temperatures. Which of the following isotherms represents Boyle’s law as PV = constant ? (T1 > T­2 > T3).

T1

T­2

P ↑ T3 P ↑ PV ↑ Log P ↑

1/V → V → P → Log V →

(i) (ii) (iii) (iv)

a) Only (ii) is correct representation of Boyle’s Law.

b) Only (iv) is correct representation of Boyle’s Law.

c) All are correct representations of Boyle’s law.

d) None of these representations is correct for Boyle’s law.

1. Which one of the given pressure versus volume plots represents Boyle’s law ?

P ↑

Gaseous pressure

1/volume

|  |  |  |  |
| --- | --- | --- | --- |
| a) Line AB | b) Line CD | c) Line EF | d) Line GH |

1. A graph is plotted between pressure and volume at different temperatures. On the basis of the graph what changes will you observe in the volume if (i) the pressure is increased at constant temperature .

(ii) the temperature is decreased at constant pressure.

P ↑

150 K

100 K `

V →

|  |  |
| --- | --- |
| a) volume increases in both the cases | b) volume decreases in both the cases |
| c) volume increases in (i) and decreases in (ii) | d) volume decreases in (i) and increases in (ii) |

1. What is the effect on the pressure of a gas if its temperature is increased at constant volume ?

|  |  |
| --- | --- |
| a) The pressure of the gas increases | b) The pressure of the gas decreases |
| c) The pressure of the gas remains same | d) The pressure of the gas becomes double |

1. A flask of capacity 2 L is heated from 35˚C to 45˚C. What volume of air will escape from the flask?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 10 mL | b) 20 mL | c) 60 mL | d) 50 mL |

1. Absolute zero can be defined as the temperature at which

|  |  |
| --- | --- |
| a) pressure becomes zero | b) volume becomes zero |
| c) mass becomes zero | d) density becomes zero |

1. At NTP the volume of a gas is 40 mL. If pressure is increased to 800 mm of Hg at the same temperature, what will be the volume of the gas ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 38 mL | b) 22400 mL | c) 240 mL | d) 431 mL |

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**Karan Arora M: 9416974837**

1. Which of the following statement does not describe Charles law ?
2. The volume of a given amount of a gas at a constant pressure varies directly to its absolute temperature.
3. For each degree change in temperature, the volume of the sample of a gas changes by the fraction 1/273 of its volume at 0˚C.
4. All gases expand or contract by the same fraction of their volume at 0˚C per degree change in temperature.
5. Vt = Vo ()
6. Study the following graph and mark the incorrect statement following it.

P1

P2

P ↑ P4 [P1 < P2 < P3 < P4]

-273.15 -200 -100 0 100

T(˚C) →

a) At zero volume all lines meet at -273.15 ˚C. This temperature is known as absolute zero.

b) Each lines of the volume vs temperature at constant pressure of graph is called isotherm.

c) All gases obey Charles’ law at very low pressure and high temperature.

d) Pressure remaining constant, volume of a gas is directly proportion to its absolute temperature

1. If we plot volume of a certain mass of a gas against temperature at constant pressure, we get a straight line intersecting on the negative side at -273 ˚C which explain about absolute zero. This graph is known as

V ↑

-273 ˚C 0 T(˚C) →

|  |  |  |  |
| --- | --- | --- | --- |
| a) isochore | b) isotherm | c) isotone | d) isobar |

1. A plot of P vs T for a given mass of gas at constant volume is a straight line. P vs T plots at constant volumes V1 and V2 for an ideal gas are shown as. Which of the following is correct?

V1

P ↑ V2

T →

|  |  |  |  |
| --- | --- | --- | --- |
| a) V1 > V2 | b) V1 < V2 | c) V1 = V2 | d) V1 = 2 V2 |

1. Volume of a given mass of gas at 17 ˚C is measured at 200 cm3 . The volume of the same mass of gas at same pressure and a temperature of 47 ˚C will be ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 77.5 cm3 | b) 13.45 cm3 | c) 220.6 cm3 | d) 320 cm3 |

1. At what temperature 28 g of N2 will occupy a volume of 20 Litres at 2 atm?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 300 K | b) 487.2 K | c) 289.6 K | d) 283.8 K |

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1. An open vessel contains air at 27 ˚C. At what temperature should it be heated so that 1/3rd of air present in it goes out ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 177 ˚C | b) 100 ˚C | c) 300 ˚C | d) 150 ˚C |

1. The relationship between various variable of gaseous substances are given along with their formulae. Mark the incorrect relationship.

|  |  |
| --- | --- |
| a) Density and Molar mass : M = | b) Universal gas constant, P, V , T : R = |
| c) Volume and pressure : V2 = | d) Volume and temperature : V2 = |

1. The correct value of the gas constant ‘R’ is close to

|  |  |
| --- | --- |
| a) 0.082 litre-atmosphere K | b) 0.082 litre-atmosphere K –1 mol – 1 |
| c) 0.082 litre-atmosphere–1 K mol – 1 | d) 0.082 litre – 1 atmosphere–1 K mol |

1. For an ideal gas, number of moles per litre in terms of its pressure, temperature and gas constant is

|  |  |  |  |
| --- | --- | --- | --- |
| a) PT/R | b) P/RT | c) PRT | d) RT/P |

1. There is a standard value of temperature and pressure at which the molar volume of a gas is 22.4 L. The correct values are

|  |  |  |  |
| --- | --- | --- | --- |
| a) 273 K , 1 atm | b) 300 K , 760 mm | c) 25 ˚C, 760 mm | d) 373 K , 1 atm |

1. How many number of moles of nitrogen will be present in 2.24 L of nitrogen gas at STP ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 9.9 | b) 0.099 | c) 0.001 | d) 1.00 |

1. Weight of CO2 in a 10 L cylinder at 5 atm and 27˚C is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 200 g | b) 224 g | c) 44 g | d) 89.3 g |

1. The volume occupied by 88 g of CO2 at 30˚C and 1 bar pressure will be

|  |  |  |  |
| --- | --- | --- | --- |
| a) 5.05 L | b) 50.36 L | c) 2 L | d) 55 L |

1. If 4 moles of an ideal gas at 300 K occupy volume of 89.6 L, then pressure of the gas will be

|  |  |  |  |
| --- | --- | --- | --- |
| a) 2 atm | b) 1 atm | c) 1.099 atm | d) 2.910 atm |

1. What will be the volume of 2.8 g of carbon monoxide at 27˚C and 0.821 atmospheric pressure ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 2.5 L | b) 4 L | c) 3.5 L | d) 3 L |

1. Molecular mass of a gas is 78 g/mol. Its density at 98˚C and 1 atm will be

|  |  |  |  |
| --- | --- | --- | --- |
| a) 200 g L – 1 | b) 2.56 g L – 1 | c) 256 g L – 1 | d) 78 g L – 1 |

1. What will be the pressure of the gas mixture of 3.2 g of methane and 4.4 g of carbon dioxide contained in a 9 dm3 flask at 27˚C

|  |  |  |  |
| --- | --- | --- | --- |
| a) 0.82 atm | b) 8.314 X 104 atm | c) 1 atm | d) 1.8 atm |

1. A closed container contains equal number of moles of two gases X and Y at a total pressure of 710 mm of Hg. If gas X is removed from the mixture, the pressure will be

|  |  |  |  |
| --- | --- | --- | --- |
| a) become double | b) become half | c) remain same | d) become one-forth |

1. 34.05 mL of phosphorus vapours weigh 0.0625 g at 546˚C and 0.1 bar pressure. What is the molar mass of phosphorus ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 124.77 g mol – 1 | b) 1247.74 g mol – 1 | c) 12.47 g mol – 1 | d) 30 g mol – 1 |

1. At 1 atmospheric pressure and 0˚C, certain mass of a gas measures 0.4 L. Keeping the pressure constant, if the temperature is increased to 273˚C, what will be its volume ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 0.8 L | b) 22.4 L | c) 54.6 L | d) 0.4 L |

1. A gas occupies a volume of 300 cm3 at 27˚C and 620 mm pressure. The volume of gas at 47˚C and 640 mm pressure is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 260 cm3 | b) 310 cm3 | c) 390 cm3 | d) 450 cm3 |

1. What is the density of CO2 at 27˚C and 2.5 atm pressure ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 5.2 g L – 1 | b) 6.2 g L – 1 | c) 7.3 g L – 1 | d) 4.46 g L – 1 |

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**Karan Arora M: 9416974837**

1. Density of a gas is found to be 5.46 g/dm3 at 27˚C and 2 bar pressure. What will be its density at STP ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 3.0 g dm – 3 | b) 5.0 g dm – 3 | c) 6.0 g dm – 3 | d) 10.82 g dm – 3 |

1. In a flask of volume V litre, 0.2 mol of oxygen , 0.4 mol of nitrogen , 0.1 mol of ammonia and 0.3 mol of helium are enclosed at 27˚C. If the total pressure exerted by these non-reacting gases is one atmosphere, then partial pressure exerted by nitrogen is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 0.1 atm | b) 0.2 atm | c) 0.3 atm | d) 0.4 atm |

1. To which of the followings the Dalton’s law of partial pressure is not applicable ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) H2 and He | b) NH3 and HCl | c) N2 and He | d) Xe and O2 |

1. Which of the following relationship between partial pressure , volume and temperature is correct ?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| (i) P = | | (ii) PTotal = p1 + p2 + p3 | | (iii) PTotal = (n1 + n2 + n3) | |
| a) (i) and (ii) | b) (i) and (iii) | | c) (ii) and (iii) | | d) (i) , (ii) and (iii) |

1. A 10 L flask contains a gases mixture of CO and CO2 at a total pressure of 2 atm and 298 K. If 0.20 mole of CO is present, then its partial pressure is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 0.49 atm | b) 1.51 atm | c) 1 atm | d) 2 atm |

1. A container of 1 L capacity contains a mixture of 4 g of O2 and 2 g of H2 at 0˚C. What will be the total pressure of the mixture ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 50.4 atm | b) 25.2 atm | c) 15.2 atm | d) 12.5 atm |

1. A bubble of air is underwater at temperature 15˚C and pressure 1.5 bar. If the bubble rises to the surface where the temperature is 25˚C and the pressure is 1 bar, what will happen to the volume of the bubble ?

|  |  |
| --- | --- |
| a) Volume will become greater by a factor of 1.5 | b) Volume will become greater by a factor of 1.1 |
| c) Volume will become smaller by a factor of 0.70 | d) Volume will become greater by a factor of 2.5 |

1. Which of the following assumptions is incorrect according to Kinetic theory of gases ?

a) Particles of a gas move in all possible directions in straight lines.

b) All the particles, at any particular time, have same speed and same kinetic energy.

c) There is no force of attractions between the particles of a gas at ordinary temperature and pressure.

d) The actual volume of the gas is negligible in comparison to the empty space between them.

1. A gas follow Boyle’s law , Charles’ law and Avogadro’s law is called an ideal gas. Under what conditions a real gas behaves as ideal gas ?

|  |  |
| --- | --- |
| a) Under low pressure and temperature | b) Under high pressure and temperature |
| c) Under high pressure and low temperature | d) Under low pressure and high temperature |

1. A person living in Shimla observed that cooking food without using pressure cooker takes more time. The reason for this observation is that at higher altitude

|  |  |
| --- | --- |
| a) pressure increases | b) temperature decreases |
| c) pressure decreases | d) temperature increases |

1. Dipole-dipole forces act between the molecules possessing permanent dipole. Ends of dipoles posses ‘partial charges’. The partial charge is

|  |  |
| --- | --- |
| a) more than unit electronic charge | b) equal to unit electronic charge |
| c) less than unit electronic charge | d) double the unit electronic charge |

1. The pressure of a 1 : 4 mixture of dihydrogen and dioxygen enclosed in a vessel is one atmosphere. What would be the partial pressure of dioxygen ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 0.8 x 105 atm | b) 0.008 N m – 2 | c) 8 x 104 N m – 2 | d) 0.25 atm |

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1. A plot of volume (V) versus temperature (T) for a gas at constant pressure is a straight line passing through the origin. The plots at different values of pressure are shown in figure. Which of the following order of pressure is correct for this gas ?

Volume (mL) ↑

Temperature (K) →

|  |  |  |  |
| --- | --- | --- | --- |
| a) P1 > P2 > P3 > P4 | b) P1 = P2 = P3 = P4 | c) P1 < P2 < P3 < P4 | d) P1 < P2 = P3 < P4 |

1. As the temperature increases, average kinetic energy of molecules increases. What would be the effect of increase of temperature on pressure provided the volume is constant ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) increases | b) decreases | c) remains same | d) Becomes half |

1. Atmospheric pressure recoded in different cities are as follow :

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cities | Shimla | Bangalore | Delhi | Mumbai |
| P in N/m2 | 1.01 x 105 | 1.2 x 105 | 1.02 x 105 | 1.21 x 105 |

Consider the above data and mark the place at which liquid will boil first.

|  |  |  |  |
| --- | --- | --- | --- |
| a) Shimla | b) Bangalore | c) Delhi | d) Mumbai |

1. Which curve in the figure represents the curve of Ideal gas ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) B only | b) C and D only | c) E and F only | d) A and B only |

1. The pressure of a mixtures of equal weights of two gases X and Y with molecular weight 4 and 40 respectively is 1.1 atm. The partial pressure of the gas X in the mixture is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 atm | b) 0.1 atm | c) 0.15 atm | d) 0.5 atm |

1. If the ratio of the masses of SO3 and O2 gases confined in a vessel is 1 : 1, then the ratio of their partial pressure would be

|  |  |  |  |
| --- | --- | --- | --- |
| a) 5 : 2 | b) 2 : 5 | c) 2 : 1 | d) 1 : 2 |

1. The correct expression of partial pressure in terms of mole fraction is

|  |  |
| --- | --- |
| a) P1 = x1 PTotal , P2 = x2 PTotal | b) P = x1 x2  PTotal |
| c) PTotal = P1 x1 , PTotal = P2 x2 | d) P1 + P2 = x1 + x2 |

1. Equal masses of helium and oxygen are mixed in a container at 25˚C. The fraction of the total pressure exerted by oxygen in the mixture of gases is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1/3 | b) 2/3 | c) 1/9 | d) 4/9 |

1. At any particular time, different particles in the gas

a) have same speed and kinetic energy

b) have same speed but different kinetic energies

c) have different speeds but same kinetic energy

d) have different speeds and hence different kinetic energies.

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**Karan Arora M: 9416974837**

1. According to kinetic theory of gases, the collisions between molecules of a gas

|  |  |
| --- | --- |
| a) occur in a zig-zag path | b) occur in a straight line |
| c) change velocity and energy | d) result in settling down of molecules |

1. Pressure of 1 g of an ideal gas A at 27˚C is found to be 2 bar. When 2 g of another ideal gas B is introduced in the same flask at the same temperature the pressure becomes 3 bar. What would be the ratio of molecular masses of A and B ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 4 : 1 | b) 1 : 4 | c) 1 : 8 | d) 2 : 8 |

1. A mixture of dihydrogen and dioxygen at one bar pressure contains 20 % by weight of hydrogen. What would be the partial pressure of dihydrogen in bar ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 0.8 | b) 1.8 | c) 2.8 | d) 3.0 |

1. What will be the pressure of the gaseous mixture when 0.5 L of H2 at 0.8 bar and 2.0 L of O2 at 0.7 bar are introduced in a 1 L vessel at 27˚C ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1.8 bar | b) 2.8 bar | c) 3.0 bar | d) 5 bar |

**Answers**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. b | 2. c | 3. c | 4. a | 5. c | 6. a | 7. b | 8. c | 9. a |
| 10. b | 11. a | 12. c | 13. b | 14. a | 15. d | 16. b | 17. d | 18. b |
| 19. c | 20. b | 21. a | 22. c | 23. b | 24. b | 25. a | 26. b | 27. d |
| 28. b | 29. c | 30. d | 31. b | 32. a | 33. b | 34. b | 35. a | 36. b |
| 37. d | 38. a | 39. d | 40. b | 41. d | 42. a | 43. b | 44. a | 45. b |
| 46. d | 47. c | 48. b | 49. c | 50. c | 51. a | 52. a | 53. a | 54. a |
| 55. b | 56. a | 57. c | 58. d | 59. b | 60. b | 61. a | 62. a |  |

**Assertion-Reason Type Questions**

**DIRECTIONS :** In each of the following questions, a statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below it. Of the statements, mark the correct answer as:

1. If both assertion and reason are true, but reason is the true explanation of the assertion.
2. If both assertion and reason are true, but reason is not the true explanation of the assertion.
3. If assertion is true, but reason is false.
4. If both assertion and reason are false.
5. **Assertion:** Dipole-dipole forces acting between the molecules possessing permanent dipole, are weaker than ion-ion interactions.

**Reason:** The attractive forces decrease with the increase of distance between the dipoles.

1. **Assertion:** Liquids and solids are hard to compress.

**Reason:** Magnitude of the repulsive forces between the molecules rises very rapidly as the distance separating the molecules decreases.

1. **Assertion:** Gases become denser at high pressure.

**Reason:** At high pressure, gases deviate from Boyle’s law

1. **Assertion:** The lowest hypothetical and imaginary temperature at which gases are supposed to occupy zero volume is called absolute zero.

**Reason:** Volume of the gas at -273.15 ˚C become zero i.e. gas does not exist at this temperature.

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1. **Assertion:** At constant temperature PV vs P plot for real gases is not a straight line.

**Reason:** In the curve of dihydrogen and helium, as the pressure increases the value of PV also increases.

1. **Assertion:** Molar volume of an ideal gas at 273.15 K and 1 bar is 22.4 L.

**Reason:** Volume of a gas is inversely proportional to temperature.

1. **Assertion:** The gases show ideal behavior when the volume occupied is large so that the volume of the molecules can be neglected in comparison to it.

**Reason:** The behavior of the gas becomes more ideal when pressure is very low.

1. **Assertion:** Compressibility factor (Z) is the ratio of actual molar volume of a gas to the calculated molar volume of it, if it were an ideal gas at that temperature and pressure.

**Reason:** At high pressure all the gases have Z < 1 and can be easily compressed.

1. **Assertion:** On cooling, ammonia liquefies first whereas CO2 requires more cooling.

**Reason:** Critical temperatures of ammonia and carbon dioxide are 405.5 K and 304.10 K respectively.

1. **Assertion:** All the gases should be cooled below their critical temperature for liquefication.

**Reason:** Cooling slows down the movement of molecules therefore, intermolecular forces may holds the slowly moving molecules together and the gas liquefies.

1. **Assertion:** At high altitudes, liquids boils at lower temperature in comparison to that at sea level.

**Reason:** At high altitudes, atmospheric pressure is low.

**Answers**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1. b | 2. a | 3. b | 4. a | 5. b | 6. d |
| 7. b | 8. c | 9. a | 10. b | 11. a |  |

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**Karan Arora M: 9416974837**

**N.C.E.R.T EXERCISE**

1. What will be the minimum pressure required to compress 500 dm3 of air at 1 bar to 200 dm3 at 30˚C ?
2. A vessel of 120 mL capacity contains a certain amount of gas at 35˚C and 1.2 bar pressure. The gas is transferred to another vessel of volume 180 mL at 35˚C. What would be its pressure ?
3. Using the equation of state pV = nRT, show that at a given temperature density of a gas is proportional to gas pressure p.
4. At 0˚C, the density of a certain oxide of a gas at 2 bar is same as that of dinitrogen at 5 bar. What is the molecular mass of the oxide ?
5. Pressure of 1 g of an ideal gas A at 27˚C is found to be 2 bar. When 2 g of another ideal gas B is introduced in the same flask at same temperature the pressure becomes 3 bar. Find a relationship between their molecular masses.
6. The drain cleaner , Drainex contains small bit of aluminium which react with caustic soda to produce dihydrogen. What volume of dihydrogen at 20˚C and one bar will be released when 0.15 g of aluminium reacts ?
7. What will be the pressure exerted by a mixture of 3.2 g of methane and 4.4 g of carbon dioxide contained in a 9 dm3 flask at 27˚C ?
8. What will be the pressure of the gaseous mixture when 0.5 L of H2 at 0.8 bar and 2 L of dioxygen at 0.7 bar are introduced in a 1 L vessel at 27˚C ?
9. Density of a gas is found to be 5.46 g/dm3 at 27˚C at 2 bar pressure. What will be its density at STP ?
10. 34.05 mL of phosphorus vapour weighs 0.0625 g at 546˚C and 0.1 bar pressure. What is the molar mass of phosphorus ?
11. A student forget to add the reaction mixture to the round bottomed flask at 27˚C but instead, he placed the flask on the flame. After a lapse of time, he realized his mistake, and using a pyrometer, he found the temperature of the flask was 477˚C. What fraction of air would have been expelled out?
12. Calculate the temperature of 4 mol of a gas occupying 5 dm3 at 3.32 bar. (R = 0.083 bar dm3 mol – 1 K – 1).
13. Calculate the total number of electrons present in 1.4 g of dinitrogen gas.
14. How much time would it take to distribute one Avogadro number of wheat grains, if 1010 grains are distributed each second ?
15. Calculate the total pressure in a mixture of 8 g of dioxygen and 4 g of dihydrogen confined in a vessel of 1 dm3 at 27˚C. R = 0.083 bar dm3 mol – 1 K – 1.
16. Payload is defined as the difference between the mass of displaced air and the mass of the balloon. Calculate the payload when a balloon of radius 10 m, mass 100 kg is filled with helium at 1.66 bar at 27˚C (Density of air = 1.2 kg m-3 and R = 0.0833 bar dm3 K-1 mol-1)
17. Calculate the volume occupied by 8.8 g of CO2 at 31.1˚C and 1 bar pressure. R = 0.083 bar L mol – 1 K – 1.
18. 2.9 g of a gas at 95˚C occupied the same volume as 0.184 g of dihydrogen at 17˚C, at the same pressure. What is the molar mass of the gas ?
19. Mixture of dihydrogen and dioxygen at one bar pressure contains 20 % by weight of dihydrogen. Calculate the partial pressure of dihydrogen.
20. What would be the SI unit for the quantity pV2T2/n ?
21. In terms of Charles law explain why - 273˚C is the lowest possible temperature.

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1. Critical temperature for carbon dioxide and methane are 31.1˚C and - 81.9˚C respectively. Which of these has stronger intermolecular forces and why ?
2. Explain the physical significance of vander waals parameters.

**Answers**

1. 2.5 bar 2. 0.8 bar 3. d = PM/RT , if T = constant , dP 4. 70 u 5. MB = 4 MA

6. 203 mL 7. 0.82 atm or 8.3 x 104 Pascal 8. 1.8 bar 9. 3 g/dm3 10. 125 g/mol

11. 3/5 12. 50 K 13. 4.215 x 1023 e –  14. 1.9 x 106 years 15. 56.025 bar

16. 3811.1 kg 17. 5.05 L 18. 40 g/mol 19. 0.8 bar 20. N m4 K2 mol – 1

21. Because at - 273˚C volume of gas become zero

22. Higher the critical temperature more easily the gas can be liquefied i.e. greater are the intermolecular forces of attraction. Hence , CO2 has strong intermolecular forces than CH4..

23. ‘a’ is a measure of the magnitude of the intermolecular forces of attraction while ‘b’ is a measure of the effective size of the gas molecules.

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