Gas Laws and Mole Concept

Que 1: ***The volume of a fixed mass of gas at 300K is 10L.What will be the volume of the gas, if the temperature is doubled without changing the pressure.***
Marks :(2)

Ans: Volume and temperature are directly proportional. Therefore volume changes to 20L / Volume doubled.

Que 2: ***The relation showing the volume and temperature of fixed mass of gas at constant pressure is tabulated below.*** ***Marks :(4)***

Volume V(L)	Temperature T(K)	V / T
600	300	2
800	.....(a).....	2
.....(b).....	450	2

i) Find out the values of a and b.

ii)State the gas law associated with this.

iii) Write down any one instance from daily life related with this law.

Ans: i) a = 400, b = 900

ii) At constant pressure, the volume of a definite mass of a gas is directly proportional to the temperature in kelvin scale.

iii) Writes suitable situations.

Que 3: ***a) What happens to the size of a gas bubble rising from the bottom of a water body?why?***

b)Which is the gas law associated with this? ***Marks :(3)***

Ans: a) size increases

As the bubbles move from bottom to top in a water body, pressure decreases and correspondingly the volume increases.

b) Boyle's law

Que 4: The volume of a fixed mass of gas at 2 atm pressure is 20L.What will be its volume if the pressure is increased 4 times without changing the temperature.
Marks :(2)

Ans: PV = a constant

2 x20 = 40

8 x X = 40

X = 40 / 8 =5

Volume changes to 5 L.

Que 5: The data of an experiment conducted on a fixed mass of gas at constant temperature are given ***Marks :(4)***

Pressure P(atm)	Volume V(L)	PV
1	10	.....(a)....
2	......(b).....	10
.....(c).....	2.5	10

i)Complete the table and find out the specialty of PV.

ii)What is the relation between pressure and volume?

iii) Which gas law can be proved by this experiment?

Ans: i) a = 10, b = 5L, c = 4 atm, PV ia a constant

ii)Volume and pressure are inversely proportional.

iii)Boyle's law

Que 6: ***What happenens to the following when the temperature of a gas in a closed container is increased ?*** ***Marks :(2)***

a) Kinetic energy

b) Pressure

Ans: a) Kinetic energy increases

b) Pressure increases

Que 7: ***When a gas contained in a 2L cylinder is completely transferred to a 4L cylinder, the volume of the gas will be ..... Marks :(1)***

Ans: 4L

Que 8: Select the statements suitable to gases from those given below.

a) Intermolecular distance is very low.

b)The volume of gas depends on the volume of the container in which it is occupied.

c)The energy of gaseous molecules is very high.

d)The attractive force between gaseous molecules is very high. ***Marks :(2)***

Ans: b) The volume of gas depends on the volume of the container in which it is occupied

c / The energy of gaseous molecules is very high.

Que 9: a) How many moles are there in 140g Nitrogen?

b) How many atoms are there in 140g Nitrogen?

(Atomic mass : N- 14) ***Marks :(2)***

Ans: (a) 5

(b) 10

Que 10: Find out the molecular mass of the following compounds

(Atomic Mass : Ca - 40 , N- 14 , C - 12 , O -16 , H- 1)

a) $Ca(NO_3)_2$ **b) $C_{12}H_{22}O_{11}$** ***Marks :(2)***

Ans: a = 164, b = 342

Que 11: $N_2 + 3\ H_2 \rightarrow 2NH_3$

The ratio of reactants and products in the above reaction is 1:3:2. Complete the table related with this reaction. ***Marks :(4)***

	Chemical reaction		
	Reactants		**Products**
	N_2	**H_2**	**NH_3**
Moles	**(a)**	**6**	**4**
Molecules	**4 x 6.022 x10^{23}**	**(b)**	**8 x 6.022 x10^{23}**
Volume at STP	**(c)**	**69.2 L**	**44.8 L**
Mass	**140 g**	**30 g**	**(d)**

Ans: a) 2

b) 12 x6.022 x10^{23}

c) 22.4 L

d) 170 g

Que 12: $NaOH + HCl \rightarrow NaCl + H_2O$ ***Marks :(3)***

a) How many moles of NaOH is needed to completely react with 1 mole of HCl ?

b) How many grams of HCl is required to completely neutralise 160g NaOH ?

Ans: a) 1

b) 146 g

Que 13: Analyse the following equation and answer the questions *Marks :(3)*

$2Na + Cl_2 \rightarrow 2NaCl$

a) What is the ratio of reactant molecules and product molecules?

b) How many moles of NaCl will be obtained on reaction of 10 moles of chlorine ?

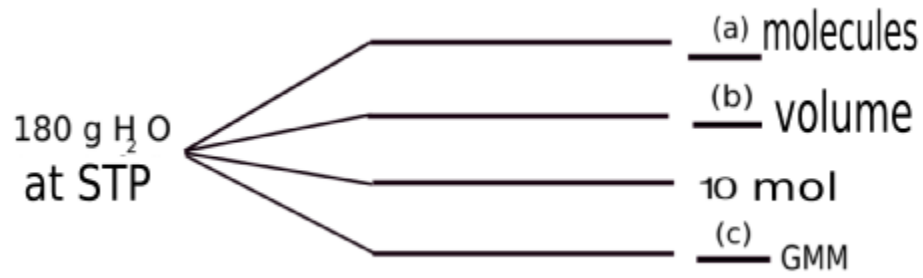
c) Find the mass of sodium required to get so much amount of NaCl .

Ans: a) 2:1:2

b)20mole

c) 20x 23 = 460g

Que 14:



i) (i)Find a,b and c

ii) How many grams of H_2O is required to get 5 x 6.022 x 10^{23} molecules ?
Marks :(4)

Ans: i)

a) 10 x 6.022 x 10^{23}

b) 224 L

c) 10 GMM

ii)

90 g H_2O

Que 15: Which of the following have the same number of moles ?

[4 GMM H_2, 88 g CO_2, 89.6 L O_2, 4 g He] ***Marks :(1)***

Ans: 4 GMM H_2, 89.6 L O_2

Que 16: Which one contains 2 x 6.022 x10^{23} Molecules ?

(28 g N_2 , 2 g H_2 , 32 g O_2 , 44.8 L CO_2) *Marks :(1)*

Ans: 44.8 L CO_2

Que 17: Which one is used as the basis of atomic mass now a days?

(H-1 , C-12 , C-14 , O – 16) ***Marks :(1)***

Ans: C-12

Que 18: 4 x 6.022 x 10^{23} Chlorine molecules at STP are taken. Answer the following

questions(Atomic mass : Chlorine = 35.5)

a) What is its volume at STP ?

b) What is the mass of this compound?

c) $H_2 + Cl_2 \rightarrow 2HCl$

How many molecules of hydrogen are required to completely react with 4 x6.022x10^{23} molecules of chlorine ? ***Marks :(3)***

Ans: a) 89.6 L

b) 284 g

c) 4 x 6.022x10^{23}

Que 19: Volume of 2 x 6.022x10^{23} molecules of a gas at STP is _____ *Marks :(1)*

Ans: 2 x 22.4L = 44.8 L

Que 20: Mass of ¼ x 6.022x10^{23} Oxygen molecule is _____ .

(Hint : Oxygen- Molecular mass = 32) ***Marks :(1)***

Ans: 8 g

Que 21: Complete the table. ***Marks :(4)***

Substance	Volume at STP	Number of moles	Mass(g)
CO_2	44.8 L	2	88
CH_4	(a)	(b)	4 g
NH_3	11.2 L	(c)	(d)

(Hint : MM : CO_2 = 18 , CH_4 = 16 , NH_3 = 17)

Ans: a) 1/4 x 22.4 = 5.6 L

b) ¼ or 0.25

c) ½

d) 8.5 g

Que 22: $N_2 + 3\ H_2 \rightarrow 2\ NH_3$

Number of moles of hydrogen required to completely react with 2 moles of nitrogen is _____ ***Marks :(1)***

Ans: 6 mole hydrogen

Que 23: 360 g glucose [$C_6H_{12}O_6$] is given. ***Marks :(2)***

a) How many molecules are there in the sample ?

b) What is the total number of atoms in the sample? (Hints: Molecular mass $C_6H_{12}O_6$ = 180)

Ans: a) GMM of $C_6H_{12}O_6$ = 180 g

Number of moles in 360g glucose = 360g / 180 g = 2

Number of molecules = 2 x 6.022×10^{23}

b) Total number of atoms = 2 x 6.022×10^{23} x 24

(1 molecule of glucose ($C_6H_{12}O_6$) contains 24 atoms)

Que 24: Which of the samples given below contains 1mole Oxygen atoms ?

(Atomic mass O = 16)

a. 16 g Oxygen.

b. 8g Oxygen.

c . 32 g Oxygen.

d . 22.4 L oxygen at STP ***Marks :(1)***

Ans: a. 16 g Oxygen.

Que 25: Some samples are given ***Marks :(4)***

(P) 22.4 L NH_3 (Q) 22 g CO_2 (R) 64 g SO_2 (S) 117 g NaCl

(GMM : NH_3 = 17 g , CO_2 = 44 g (c) SO_2 = 64 g (d) NaCl = 58.5 g)

a) Which among the above are having the same moles?

b) How many molecules are there in sample Q?

c) How many grams of NH_3 are needed to get the same number of molecules in sample S ?

Ans: a) P, R

b) 22 g CO_2 is 0.5 mole, Number of molecules = ½ x 6.022×10^{23}

(c)117 g NaCl= 2mole = 2 x $6.022x10^{23}$ molecules

Mass of 2 mole NH_3 = 2 x 17 g = 34 g

Que 26: Which among the following samples have the same number of molecules.

a) 88 g CO_2 b) 54 g H_2O c) 4 g H_2 d) 17 g NH_3

(Atomic mass : C = 12 , O = 16 , H = 1 ,N =14) ***Marks :(2)***

Ans: a, c

Que 27: The equation showing the reaction of Zinc with hydrochloric acid is given.

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

a) How many molecules of $ZnCl_2$ will formed on complete reaction of 65g Zn with HCl?

b) What will be the volume of H_2 formed at STP when 6.5g Zn reacts with HCl.

(Hint: Atomic mass : Zn = 65 , Cl = 35.5 , H= 1) ***Marks :(3)***

Ans: a) $6.022x10^{23}$

b) 0.1 x 22.4 = 2.24

Que 28: $2Mg + O_2 \rightarrow 2MgO$ ***Marks :(3)***

The equation showing the burning of Magnesium is given. suppose 120g of Mg is burned.

a) How many atoms are there in 120g Mg ?

b) How much will be the volume of oxygen at STP to burn this much Mg?

c) What will be the mass of Magnesium Oxide formed ?

(Hint : Atomic mass : O = 16, Mg = 24)

Ans: a) (120/24) x $6.022x10^{23}$ = 5 x $6.022x10^{23}$

b) 5/2 x $6.022x10^{23}$

c) 5 x (24+16) = 5 x 40 g = 200g

Que 29: Match the following. ***Marks :(3)***

A	B	C
10 g H_2	**3 x $6.022x10^{23}$**	**2 mol atoms**
54 g H_2O	**2 GAM**	**112 L at STP**
32 g O_2	**5 x $6.022x10^{23}$**	**3 GMM**

Ans:

A	B	C
10 g H_2	5 x 6.022x10^{23}	112 L at STP
54 g H_2O	3 x 6.022x10^{23}	3 GMM
32 g O_2	2 GAM	2 mol Atoms

Que 30: $H_2 + Cl_2 \rightarrow 2HCl$

The above experiment is carried out by using 10g H_2 and 142g Cl_2.

a) How many molecules are there in 142g of Cl_2.

b) what is the volume of each of the above gas at STP?

c) How many molecules of HCl will be formed in the reaction ?

(Hint : Atomic mass : H = 1 , Cl = 35.5)*Marks :(4)*

Ans: a) 2 x 6.022x10^{23}

b) H_2 - 5 x 22.4 L = 112L

Cl_2 - 2 x 22.4L = 44.8 L

c) 4 x 6.022x10^{23} molecules (4mol molecules or $4N_A$ molecules)

Que 31: Choose the correct statements from those given below

a) The volume of a mole of gas at 300K and 1atm is 22.4 L .

b) 1GMM of any substance contains 6.022x10^{23}molecules.

c) The mass of 6.022x10^{23} O_2 molecules is 16g .

d) The mass of 22.4L of oxygen at 273K and 1atm pressure is 32 g *Marks :(2)*

Ans: statements b,d .

Que 32: Choose the correct statements from those given below

a) The volume of a mole of gas at 300K and 1atm is 22.4 L .

b) 1GMM of any substance contains 6.022x10^{23}molecules.

c) The mass of 6.022x10^{23} O_2 molecules is 16g .

d) The mass of 22.4L of oxygen at 273K and 1atm pressure is 32 g *Marks :(2)*

Ans: statements b,d .

Que 33: Arrange the following samples in the increasing order of their mass.

a) 5 GMM CO_2

b) 10 GMM Oxygen

c) 2 mol H_2O

d) 3 mol N_2

(Hint: Molecular mass- CO_2 = 44, O_2 = 32, H_2O = 18, N_2 = 28) ***Marks :(3)***

Ans: a = 220g, b = 320g, c = 36g, d = 84g

c < d < a < b

Que 34: Arrange the following samples in the ascending order of number of moles.

a) 90 g H_2O

b) 48 g CH_4

c) 100 g $CaCO_3$

d) 96 g SO_2

(Hint: Molecular mass- H_2O =18, CH_4 = 16, $CaCO_3$ = 100, SO_2 = 64) ***Marks :(3)***

Ans: a = 5,b=3,c=1 d=1.5

c < d < b < a

Que 35: Complete the table. (Hint : atomic mass : He = 4 , N=14 , O =16 , P = 31) ***Marks :(4)***

Substance	Atomic mass	Amount taken(g)	Number of molecules	number of atoms
He	**4**	**10**	**(a)**	**(b)**
N_2	**14**	**(c)**	**6.022×10^{23}**	**(d)**
Cl_2	**35.5**	**(e)**	**(f)**	**$10 \times 6.022 \times 10^{23}$**
O_2	**(g)**	**80**	**(h)**	**$5 \times 6.022 \times 10^{23}$**

Ans: a = $2.5 \times 6.022 \times 10^{23}$ b = $2.5 \times 6.022 \times 10^{23}$ c = 28g

d= $2 \times 6.022 \times 10^{23}$ e = 355 g f= $5 \times 6.022 \times 10^{23}$

g = 16 h = $2.5 \times 6.022 \times 10^{23}$

Que 36: Arrange the following samples in the increasing order of number of atoms.

(hint : atomic mass : H = 1 C = 12 O =16 Ca = 40)

a) 10 g Hydrogen b) 100 g Calcium c) 64g Oxygen d) 36g Carbon ***Marks :(3)***

Ans: a) 10 GAM b) 2.5 GAM c) 4 GAM d) 3GAM

b < d < c < a

Que 37: 1mL of oxygen at constant temperature and pressure contains x molecules.

write answer related to the following gases at same temperature and pressure.

a) Number of molecules in 1mL hydrogen?

b)Number of molecules in 5mL nitrogen ?

c)Volume of 3x molecules of CO_2 ? ***Marks :(3)***

Ans: a = x, b = 5x, c = 3mL

Que 38: Choose the correct statements from those given below .

(Hint : Atomic mass : C - 12 , O - 16)

a) 6.022 x 10^{23} molecules are there in 22 g CO_2.

b) 1 GMM of CO_2 is 22 g .

c) Volume of 22 g CO_2 at STP is 11.2 L.

d) 22 g of CO_2 contains3 x ½ x 6.022 x 10^{23} atoms. ***Marks :(2)***

Ans: c,d

Que 39: Pick the odd one out ?

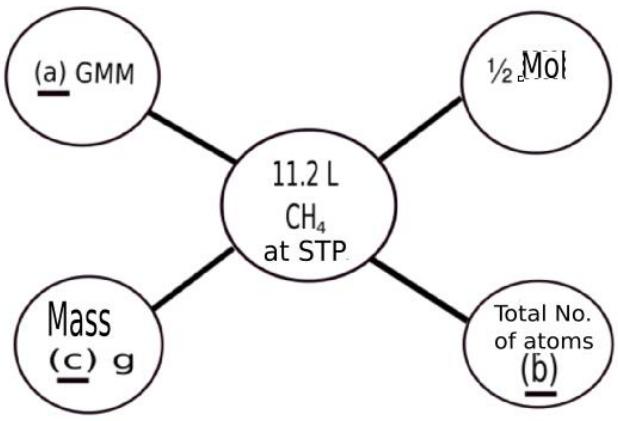
64 g SO_2 , 2 x 6.022 x 10^{23} H_2 molecules , 64 g O_2 , 44.8 L CO_2 at STP

(Atomic mass : S - 32 , O -16) ***Marks :(1)***

Ans: 64 g SO_2

Que 40: Find a,b,c . ***Marks :(3)***

(Hint: MM- CH_4 =16)



Ans: a) ½ GMM

b) ½ x 5 x 6.022 x 10^{23}

c) 8 g

Que 41: ***The mathematical representation of some gas laws are given. Identify the law related to each one.*** ***Marks :(3)***

a) V∝T

b)V ∝ 1/p

c)V∝n

Ans: a) C*harles' law*

b) Boyle's law

c) Avogadro's Law

Que 42: ***Find out the gas law related with each of the following instances.***

a) The size of the balloon increases as it is inflated.

b) An inflated balloon kept in direct sunlight is found to burst.

c) Gases can be marketed in cylinders. ***Marks :(3)***

Ans: a) *Avogadro's Law*

b) Charles' law
c) Boyle's law

Que 43: An inflated balloon contains X air molecules. After some time the volume of the balloon is found to be the half at the same temperature and pressure when a few air molecules are expelled out.

a) How many molecules will be there in the balloon now?

b) Which is the gas law associated with this? ***Marks :(2)***

Ans: a = X /2,

b -*Avogadro's Law*

Que 44: The mass of 5 GAM X is 80g . [Symbol is not real]

a) What is the atomic mass of this element ?

b) How many atoms are there in 80g X?

c) How many grams of helium are to be taken to get as many molecules as there in X?

(Atomic mass : He = 4) ***Marks :(3)***

Ans: a) 16
b) 5 x 6.022x10^{23}
c) 20 g