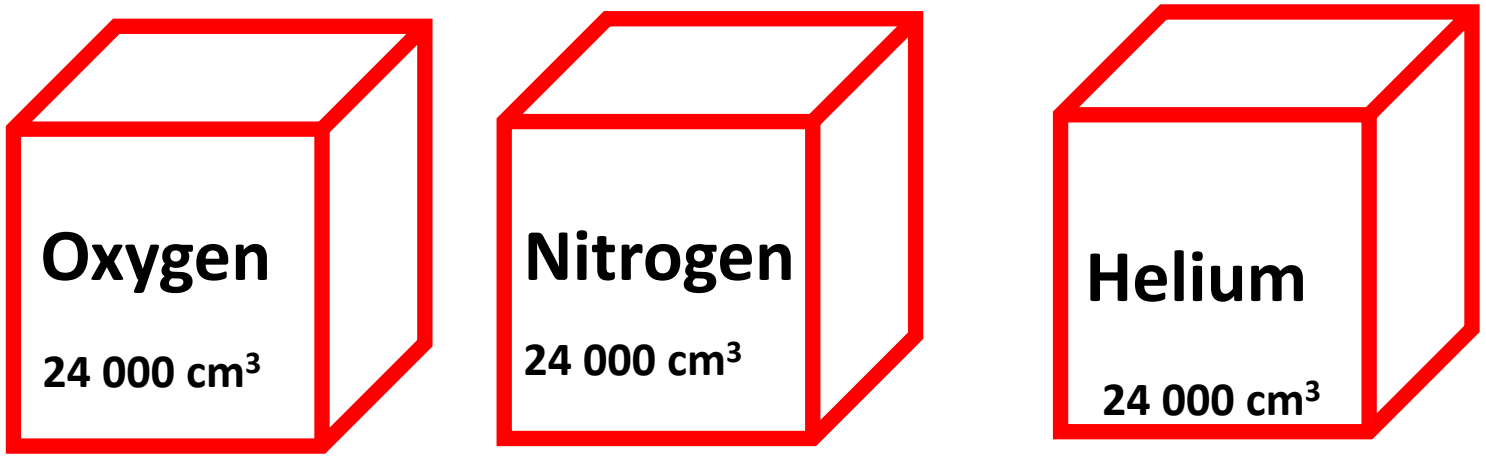
Key Concepts for A Level Chemistry

Introduction to Chemistry Calculations Part 3 - Gases

Gases

One mole of any gas has a volume of 24 000 cm^3 at room temperature and pressure.



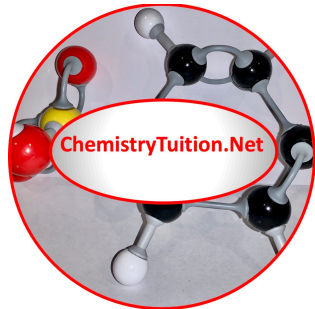
$$\text{Volume of gas} = \text{number of moles} \times 24000$$

$$\text{number of moles} = \frac{\text{Volume of gas}}{24000}$$

Volume of gas	=	number of moles	X	24000

Calculate the volume of the number of moles of gas stated.

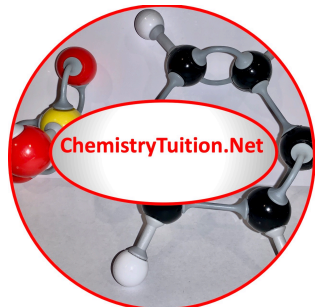
1 mole of CO_2	1 x 24000	=	24000	cm^3
0.1 moles of NH_3	0.1 x 24000	=	2400	cm^3
0.5 moles of C_2H_4	0.5 x 24000	=	12000	cm^3
2 moles of SO_2	2 x 24000	=	48000	cm^3
0.12 moles of SO_3	0.12 x 24000	=	2880	cm^3



$$\text{number of moles} = \frac{\text{Volume of gas}}{24000}$$

Calculate the number of moles of gases stated below

80 cm^3 of HBr	=	80/24000	0.003	mols
5000 cm^3 of HI	=	5000/24000	0.208	mols
20 000 cm^3 of NO_2	=	20000/24000	0.833	mols
420 cm^3 of F_2	=	420/24000	0.018	mols



Calculate the mass of the volume of gases stated

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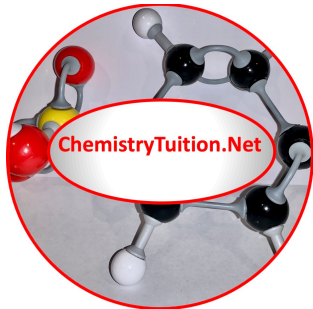
Mass in grams = number of moles X Relative Molecular Mass

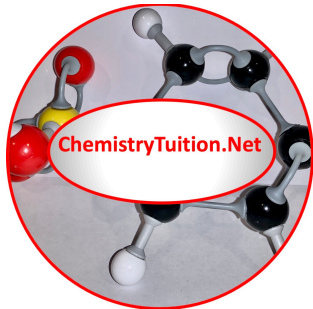
number of moles = $\frac{\text{Volume of gas}}{24000}$

2000 cm^3 of SO_2
234 cm^3 of SO_3
226 cm^3 of HBr
256 cm^3 of Cl_2
200 cm^3 of CH_4



$$\text{number of moles} = \frac{\text{Volume of gas}}{24000}$$

2000 cm^3 of SO_2	2000/24000	=	0.083333333	mols
234 cm^3 of SO_3	234/24000	=	0.00975	mols
226 cm^3 of HBr	226/24000	=	0.009416667	mols
256 cm^3 of Cl_2	256/24000	=	0.010666667	mols
200 cm^3 of CH_4	200/24000	=	0.008333333	mols

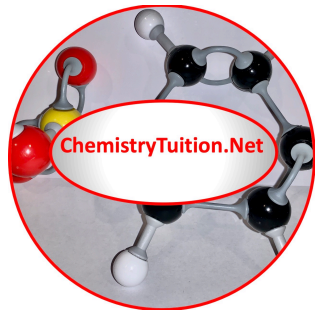


Mass in grams = number of moles X Relative Molecular Mass

2000 cm^3 of SO_2	=	0.083333333	mols
234 cm^3 of SO_3	=	0.00975	mols
226 cm^3 of HBr	=	0.009416667	mols
256 cm^3 of Cl_2	=	0.010666667	mols
200 cm^3 of CH_4	=	0.008333333	mols

SO_2	32 + (2 x 16) = 64
SO_3	32 + (3 x 16) = 80
HBr	80 + 1 = 81
Cl_2	2 x 35.5 = 71
CH_4	12 + (4 x 1) = 16

2000 cm^3 of SO_2	Mass of gas	0.083333333 x 64	=	5.33	grams
234 cm^3 of SO_3	Mass of gas	0.00975 x 80	=	0.78	grams
226 cm^3 of HBr	Mass of gas	0.009416667 x 81	=	0.763	grams
256 cm^3 of Cl_2	Mass of gas	0.010666667 x 71	=	0.757	grams
200 cm^3 of CH_4	Mass of gas	0.008333333 x 16	=	0.133	grams

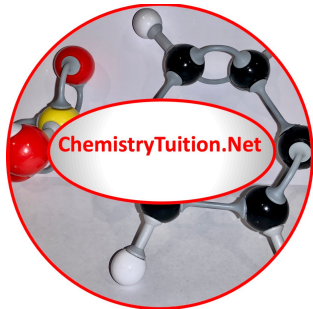


In each case calculate the volume on cm^3 of the mass of gas given.

200 g of H_2
240 g of O_2
70 g of C_2H_6
56 g of C_3H_8
22 g of C_2H_2

Volume of gas = number of moles X 24000

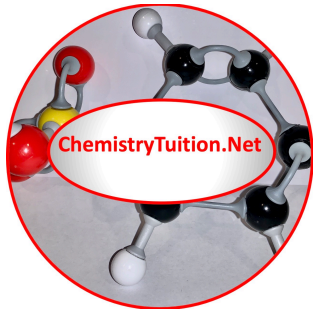
$$\text{number of moles} = \frac{\text{Mass in grams}}{\text{Relative Molecular Mass}}$$



$$\text{number of moles} = \frac{\text{Mass in grams}}{\text{Relative Molecular Mass}}$$

H_2	2 x 1 = 2
O_2	2 x 16 = 32
C_2H_6	(2 x 12) + (6 x 1) = 30
C_3H_8	(3 x 12) + (8 x 1) = 44
C_2H_2	(2 x 12) + (2 x 1) = 26

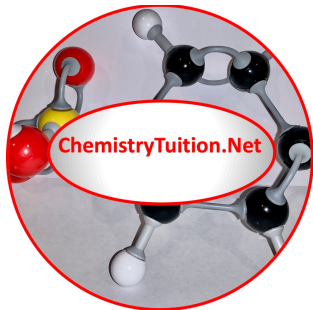
200 g of H_2	200/2	=	100	mols
240 g of O_2	240/32	=	7.50	mols
70 g of C_2H_6	70/30	=	2.33	mols
56 g of C_3H_8	56/44	=	1.27	mols
22 g of C_2H_2	22/26	=	0.85	mols



Volume of gas = number of moles X 24000

200 g of H_2	=	100	mols
240 g of O_2	=	7.5	mols
70 g of C_2H_6	=	2.333	mols
56 g of C_3H_8	=	1.273	mols
22 g of C_2H_2	=	0.846	mols

200 g of H_2	100 x 24000	=	2400000	cm^3
240 g of O_2	7.5 x 24000	=	180000	cm^3
70 g of C_2H_6	2.333 x 24000	=	55992	cm^3
56 g of C_3H_8	1.273 x 24000	=	30552	cm^3
22 g of C_2H_2	0.846 x 24000	=	20304	cm^3

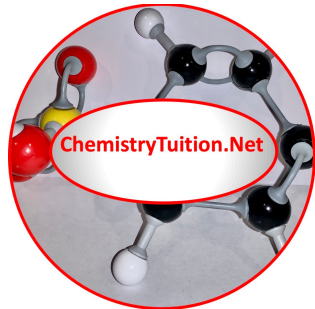


Calculate the Relative Molecular Mass of the gas below from their volume.

$$\text{Relative Molecular Mass} = \frac{\text{Mass in grams}}{\text{number of moles}}$$

0.373 g of gas occupy 56 cm^3
0.747 g of gas occupy 280 cm^3
0.467 g of gas occupy 140 cm^3
0.296 g of gas occupy 100 cm^3

$$\text{number of moles} = \frac{\text{Volume of gas}}{24000}$$

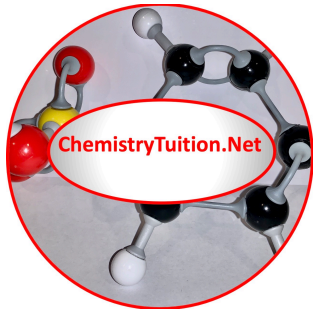


$$\text{number of moles} = \frac{\text{Volume of gas}}{24000}$$

0.373 g of gas occupy 56 cm^3	56/24000	=	0.0023
0.747 g of gas occupy 280 cm^3	280/24000	=	0.0117
0.467 g of gas occupy 140 cm^3	140/24000	=	0.0058
0.296 g of gas occupy 100 cm^3	100/24000	=	0.0042

$$\text{Relative Molecular Mass} = \frac{\text{Mass in grams}}{\text{number of moles}}$$

0.373/0.0023	=	162.2
0.747/0.0117	=	63.8
0.467/0.0058	=	80.5
0.296/0.0042	=	70.5

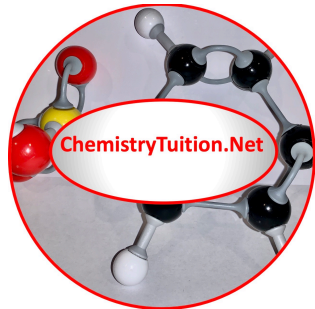


$$\text{Number of moles} = \frac{\text{Mass in grams}}{\text{Relative Atomic or Molecular Mass}}$$

$$\text{Mass in grams} = \text{Number of moles} \times \text{Relative Atomic or Molecular Mass}$$

$$\text{Volume of gas} = \text{Number of moles} \times 24000$$

$$\text{Number of moles} = \frac{\text{Volume of gas}}{24000}$$



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