CHEMISTRY

BOOKS - EVERGREEN CHEMISTRY (ENGLISH)

MOLE CONCEPT AND STOICHIOMETRY

Numerical Assignments

1. Calculate the volume occupied by 7 grams of nitrogen gas (molar mass = 28 g)

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2. At STP, 14 g of nitrogen occupies 11.2 litres. Use this information to determine the atomicity of nitrogen. It is given that molar

volume of nitrogen at STP is 22.4 L.

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3. Calculate the mass of one molecule of oxygen. It is given that molar mass of O_2 is 32 g and Avogadro's number is 6.022×10^{23}

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4. A gas cylinder can hold 1 kg of hydrogen gas at room temperature and 1 atm pressure. Calculate the following:

The mass of carbon dioxide which the cylinder could hold under similar conditions of temperature and pressure. (Molar mass of CO2 = 44 g)

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5. A gas cylinder can hold 1 kg of hydrogen gas at room temperature and 1 atm pressure. Calculate the following:

The number of molecules of carbon dioxide in the cylinder. Give reasons to justify your answer. Mass of the substance

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Illustrative Numericals On Percentage Composition

1. Calculate the mass percentage of each element in water (H_2O)

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2. Compute the percentage composition of cane sugar $(C_{12}H_{22}O_{11})$

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3. The molecular formula of Mohr's salt is

$(NH_4)_2SO_4FeSO_4.6H_2O$

Find the number of atoms of each element.

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$(NH_4)_2SO_4FeSO_4.6H_2O$

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5. The molecular formula of Mohr's salt is

$(NH_4)_2SO_4FeSO_4.6H_2O$

What is the percentage of water of hydration in Mohr's salt?

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6. Calculate the total percentage of oxygen in magnesium nitrate crystals $Mg(NO_3)_2.6H_2O$ (Atomic masses H = 1, N = 14, O = 16, Mg = 24)

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7. Calculate the percentage of platinum in ammonium chloroplatinate $(NH_4)_2PtCI_6$ (Give your answer correct to the nearest whole number).

(Atomic masses: H = 1, N = 14, CI = 35.5, Pt = 195)

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8. Calculate the percentage of phosphorus in the fertiliser superphosphate $Ca(H_2PO_2)_2$

(H = 1, 0 = 16, P = 31, Ca = 40).

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9. Calculate the mass of chromium atoms in 85 g of Cr_2S_3.

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Questions

1. Calculate the number of moles in 22 g of CO_2

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2. Calculate the number of molecules in 8 grams of O_2.

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3. Calcualte the number of molecules in 5.6 litres of a gas at STP

A. Mole $= \dfrac{\text{Volume of the gas at STP}}{\text{Molar volume of the gas at STP}}$

$= \dfrac{5.6}{22.4L} = 0.25$

Numbers of molecules

$= \dfrac{\text{Volume of the gas at STP}}{\text{Molar volume of the gas at STP}} \times$ Avogadro's number

$= \dfrac{5.6L}{22.44L} \times 6.022 \times 10^{23} = 1.5 \times 10^{23}$

B.

C.

D.

Answer:

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4. Calculate the volume of 320 g of SO_2 at STP. (Atomic mass S=32 and O=16)

A. Molar mass of $SO_2 = 32 + 2 \times 16 = 64g$

$$V(SO_2) = \frac{320g}{64g} \times 22.4L = 112L$$

B.

C.

D.

Answer:

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5. The vapour density of ethane is 8. What is its molecular mass and gram molecular mass ?

A. Molecular mass $= 2 \times$ Vapourn density $= 2 \times 8 = 16$

Gram molecular mass $= 2g \times 8 = 16g$

B.

C.

D.

Answer:

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6. Atomic mass of oxygen is 16 What is its vapour density ?

A. Oxygen is a diatomic molecular. Therefore,

Vapoure density of $O_2 = \frac{1}{2} \times$ Molecular mass of oxyge

=A Atomic mass of oxygen =16

B.

C.

D.

Answer:

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7. The vapour density of carbon dioxide is 22 Explain this statement.

(i) The molecule of a given volume of CO_2 is 22 times greater than the mass of the same volume of H_2.

(ii) The molecular mass of $CO_2 = 2 \times 22 = 44$

A. A molecular of carbon dioxide is 22 this statement means that

B.

C.

D.

Answer:

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8. A gas cylinder full of hydrogen gas contains 6 g of this gas. The same cylinder can hold 102 g of a gas X under the same conditions of temperature and pressure.

Calculate the vapour density of the gas X

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9. A gas cylinder full of hydrogen gas contains 6 g of this gas. The same cylinder can hold 102 g of a gas X under the same conditions of temperature and pressure.

Calculate the vapour density of the gas X

A. Molecular mass $X = 2 \times$ Vapour density of gas

$X = 2 \times 17 = 34$

B.

C.

D.

Answer:

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10. A gas cylinder of capacity of $20dm^3$ is filled with gas X, the mass of which is 10g. When the same cylinder is filled with hydrogen gas at the same temperature and pressure, the mass of the hydrogen is 2g. Hence the relative molecular mass of the gas is

A. 5

B. 10

C. 15

D. 20

Answer:

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11. Calcuate the mass of

10^{22} atoms of sulphur.

[Atocmi mass S=32,C and O=16 and Avogadro's number $= 6 \times 10^{23}$

]

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12. Calculate the mass of

0.1 mole of carbon dioxide.

[Atomic mass : S = 32, C = 12 and O = 16 and Avogadro.s Number = 6×10^{23}]

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13. Calcualte the volume occupied by 0.1 mol of CO_2 at STP.

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14. State the Avogadro law of ideal gas

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15. Write the empirical formula for each of the following:

C_2H_6

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16. Write the empirical formula for each of the following:

C_6H_6

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17. Write the empirical formula for each of the following:

$C_4H_8O_2$

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18. Write the empirical formula for each of the following:

Na_2CO_3

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19. Write the empirical formula for each of the following:

C_4H_{10}

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20. when gases react together their reacting volumes bear a simple ratio to each other under the same conditions of temperature and pressure . Who proposed this law ?

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21. State Gay-Lussac.s Law of combining volumes.

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Numerical Problems

1. What mass of oxygen will contain 2 mol of O_2 molecules? Molar mass of O_2 is 32 gmol^{-1}.

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2. Compute the mass in grams for each of the following:

3.0 mol of NH_3

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3. Compute the mass in grams for each of the following:

0.4 mol of CO_2

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4. Compute the mass in grams for each of the following:

5.0 mol of H_2IO_6 Relative atomic mases: H=1,0 = 16, I = 127

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5. Calculate the number of H_2O molecules in 0.06 g of water. [Molar mass of $H_2O = 18gmol^{-1}$]

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6. How many Ag atoms are there in 0.001 g of silver? Take atomic mass of Ag = 108 and Avogadro's number $=6.023 \times 10^{23}$.

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7. At STP, 11 g of carbon dioxide gas (molar mass of $CO_2 = 44gmol^{-1}$) is filled in a container. Compute the following quantities of the gas.

Number of carbon and oxygen atoms

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8. At STP, 11 g of carbon dioxide gas (molar mass of $CO_2 = 44gmol^{-1}$) is filled in a container. Compute the following quantities of the gas.

Number of molecules

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9. At STP, 11 g of carbon dioxide gas (molar mass of $CO_2 = 44 g mol^{-1}$) is filled in a container. Compute the following quantities of the gas.

Number of carbon and oxygen atoms

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10. At STP, 11 g of carbon dioxide gas (molar mass of $CO_2 = 44 g mol^{-1}$) is filled in a container. Compute the following quantities of the gas.

Volume of the gas

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11. Under the same conditions of temperature and pressure, $2LCO_23ICI_25LH_24LN_2$ and $1LSO_2$ are collected in different containers. In which gas sample will there be

the greatest number of molecules?

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12. Under the same conditions of temperature and pressure, $2LCO_23ICI_25LH_24LN_2$ and $1LSO_2$ are collected in different containers. In which gas sample will there be

the least number of molecules? Justify your answer.

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13. The gases hydrogen, oxygen, carbon dioxide, sulphur dioxide and chlorine are arranged in order of their increasing relative

molecular mass. Given 10 g of each gas at STP, which gas will contain the least number of molecules and which gas the most?

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14. Samples of the gases O_2, N_2, CO_2 and CO under the same conditions of temperature and pressure contain the same number of molecules represented by X. The molecules of oxygen (O_2) occupy V litres and have a mass of 8 g. Under the same conditions of temperature and pressure, answer the following questions:

What is the volume occupied by

X moelcules of N_2

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15. Samples of the gases O_2, N_2, CO_2 and CO under the same conditions of temperature and pressure contain the same number

of molecules represented by X. The molecules of oxygen (O_2) occupy V litres and have a mass of 8 g. Under the same conditions of temperature and pressure, answer the following questions:

What is the volume occupied by

3X molecules of CO?

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16. Samples of the gases O_2, N_2, CO_2 and CO under the same conditions of temperature and pressure contain the same number of molecules represented by X. The molecules of oxygen (O_2) occupy V litres and have a mass of 8 g. Under the same conditions of temperature and pressure, answer the following questions:

What is the mass of CO_2 in gram ?

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17. Samples of the gases O_2, N_2, CO_2 and CO under the same conditions of temperature and pressure contain the same number of molecules represented by X. The molecules of oxygen (O_2) occupy V litres and have a mass of 8 g. Under the same conditions of temperature and pressure, answer the following questions:

In answering the above questions, name the law you have used?

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18. A gas of mass 32 gm has a volume of 20 litre at S.T.P. Calculate the gram molecular weight of the gas.

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19. Complete the calculation. Show working for complete credit :

Calculate the mass of calcium that will contain the same number of

atoms as are present in 3.2 gm of sulphur. [Atomic masses : S = 32, Ca = 40]

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20. The mass of 11.2 litre of a certain gas at S.T.P. is 24 g. Find the gram molecular mass of the gas.

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21. Calculate the volume occupied by 2.4 g of a gas at STP when its vapour density is 11.2

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Questions For Practice

1. Express 144 pencils in dozen and gross.

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2. ____ is used to report the amount of chemical substance.

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3. How many O_2 molecules are there in one mole of oxygen gas?

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4. Calculate the number of CO_2 molecules in 10 moles of it.

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5. How many N atoms are present in 0.25 mol of N_2 ?

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6. The molecular formula of an organic acid is H_2CO_2 What is its empirical formula?

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7. What is the percentage composition of $Al_2(SO_4)_3$? [R.A.M.: O = 16, Al = 27, S = 32.]

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8. Calculate the molecular mass and percentage composition of HgO. [R.A.M.: O = 16, Hg = 200.6.]

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9. Calculate the mass percent of chromium in potassium dichromate $K_2Cr_2O_7$ [R.A.M. :0 = 16, K = 39, C = 52.]

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10. Calculate the molecular mass of haemoglobin $C_{3021}H_{4780}O_{896}N_{760}S_{12}e_4$ and find the mass percentage of iron (Fe) in this molecule. [R.A.M.: H = 1, C = 12, N = 14, O = 16, S=32, Fe=56]

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11. Calculate the percentage composition of a compound which has molecular formula N_2O_4 [R.A.M.: N = 14, O = 16.]

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12. Both carbon monoxide (CO) and carbon dioxide (CO_2) are binary compounds of carbon and oxygen. Show by calculations that both the compounds contain different percentages of the two elements. [R.A.M.: C = 12, O = 16.]

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13. Both sodium sulphate (Na_2SO_4) and sodium sulphite (Na_2SO_3) are the compounds of sodium, sulphur and oxygen. By calculations prove that the quantity of oxygen in sodium sulphate is greater than that in sodium sulphite. (R.A.M. : Na = 23, S = 32, O = 16.]

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14. Determine the percentage composition of water (H_2O) in hydrogen peroxide H_2O_2 [R.A.M.: H = 1, 0 = 16.]

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15. Which contains larger percentage of oxygen, H_2O or N_2O_3?

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16. Calculate the percentage of nitrogen in ammonium nitrate (NH_4NO_3) [R.A.M: H = 1, N = 14,0 = 16]

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17. What mass of sulphur is contained in 30 g of iron pyrites (FeS_2)?

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18. What mass of sulphur is contained in 30 g of iron pyrites $(Na_2B_4O_7, 10H_2O) = H = 1B = 11, O = 16, Na = 23)$

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19. Calculate the percentage of nitrogen and oxygen in ammonium nitrate. [Relative molecular mass of ammonium nitrate is 80, H = 1, N = 14, O = 16).

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20. Calculate the percentage of water of crystalization in $CuSO_{4.5}H_2O$

(H = 1, O = 16, S = 32, Cu = 64)

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21. A compound contains 50% Ca, 15% C and 35% N atoms by mass. Determine the simplest formula of the compound. (R.A.M.: C = 12, N = 14, Ca = 40.)

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22. Sodium chloride is composed of 39.4% sodium and 60.6% chlorine. Prove by calculations that its empirical formula is NaCl. (R.A.M. : Na = 23, CI = 35.5)

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23. In a compound 8 g of sulphur combine with 8 g of oxygen. What is the empirical formula of the compound? (R.A.M.: S = 32, O = 16).

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24. A compound is composed of 43.4% Na, 11.32% C and rest of oxygen by mass. Derive a empirical formula of the compound. (R.A.M.: C = 12, O = 16, Na - 23)

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25. A compound contains 10% C, 0.8% H and 89.2% Cl by mass. Determine its simplest formula. (R.A.M.: H = 1, C = 12, Cl = 35.5)

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26. A compound contains 25.52% C, 6.38% H and 68.1% S by mass. If the molecular mass of the compound is 94, determine its molecular formula.

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27. Write the empirical formula of each one of the following:

H_{2O_2}

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28. Write the empirical formula of each one of the following:

CO_2

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29. Write the empirical formula of each one of the following:

C_6H_6

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30. Write the empirical formula of each one of the following:

$C_6H_{12}O_6$

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31. Write the empirical formula for each of the following:

C_4H_{10}

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32. Write the empirical formula of each one of the following:

C_6H_{12}

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33. Write the empirical formula of each one of the following:

$C_2H_6S_2$

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34. Write the empirical formula of each one of the following:

$C_6H_8N_2$

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35. The molecular formula of an organic acid is H_2CO_2 What is its empirical formula?

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36. A compound is composed of 2.2% hydrogen, 26.6% carbon and 71.2% oxygen. Calculate the empirical formula of the compound. If its molecular mass is 90, find its molecular formula.

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37. A compound is composed of 29.11% sodium, 40.51% sulphur and 30.38% oxygen. Find its empirical formula. (R.A.M. : Na = 23, S = 32, O = 16.)

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38. A compound contains 87.5% nitrogen and 12.5% hydrogen by mass. Determine the empirical formula and molecular of this compound if its molecular mass is 32

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39. An organic compound with vapour density 94 contains C = 12.67%, H = 2.13% and Br = 85.20%. Find the molecular formula. (Atomic mass: C = 12, H = 1, Br = 80)

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40. A gaseous hydrocarbon contains 82.76% of carbon. Given that its vapour density is 29, find its molecular formula (C = 12, H = 1).

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41. If the empirical formula of a compound is CH and its vapour density is 13, find the molecular formula of the compound.

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42. Compound of X and Y has the empirical formula XY. Its vapour density is equal to its empirical formula mass. Determine its molecular formula.

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43. Nitrogen and oxygen gases combine to form nitric oxide: $N_2(g) + O_2(g) \rightarrow 2NO(g)$.

Calculate the volume of nitrogen required to produce $30\ \ \mathrm{dm}^3$ of NO gas.

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44. For the reaction

$N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

If pressure id increased by reducing the volume of the container then :

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45. What volume of propane is burnt for every $100\ \ \mathrm{cm}^3$ of oxygen used in the reaction $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$? Gas volumes are measured under the same conditions.

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46. Find the volume of sulphur dioxide (at STP) that would be liberated by roasting 30 g of iron pyrites according to the equation $4FeS_2 + 11O_2 \rightarrow 2Fe_2O_3 + 8SO_2$.

(Atomic mass : $S = 32, Fe = 56, O = 16,$ molar volume of gas is 22.4 litres at STP.)

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47. What volume of hydrogen sulphide at STP will burn in oxygen to yield 12.8 g of sulphur dioxide according to the equation $2H_2S + 3O_2 \rightarrow 2H_2O + 2SO_2$.

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48. What volume of dioxygen is required for complete combustion of 2 volume of acetylene gas at NTP ?

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49. Calcium hydroxide and ammonium chloride react to give ammonia as per equation:

$Ca(OH)_2 + 2NH_4Cl \rightarrow CaCl_2 + 2NH_3 + 2H_2O$

In a reaction, 5.35g of ammonium chloride were consumed .

Calculate

The mass of calcium chloride formed.

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50. Calcium hydroxide and ammonium chloride react to give ammonia as per equation:

$Ca(OH)_2 + 2NH_4Cl \rightarrow CaCl_2 + 2NH_3 + 2H_2O$

In a reaction, $5.35g$ of ammonium chloride were consumed . Calculate

The volume at STP of ammonia liberated.

$(R.\ A.\ M.: H = 1, N = 14, O = 16, Cl = 35.5, Ca = 40)$

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51. Carbon monoxide combines with oxygen to form carbon dioxide according to the equation:

$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$.

$200cm^3$ of carbon monoxide is mixed with $200cm^3$ of oxygen at room temperature and ignited.

Calculate the volume of carbon dioxide formed when cooled to room temperature.

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52. Carbon monoxide combines with oxygen to form carbon dioxide according to the equation:

$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$.

$200cm^3$ of carbon monoxide is mixed with $200cm^3$ of oxygen at room temperature and ignited.

What other gas, if any, may also be present ?

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53. On passing carbon dioxide over red hot carbon, carbon monoxide is produced as pe the equation $CO_2 + C \rightarrow 2CO$. Calculate the volume of carbon monoxide at STP wher 3 g of carbon is consumed in the reaction.

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54. When hydrogen burns in oxygen, water vapour is produced:

$2H_2(g) + O_2(g) \rightarrow 2H_2O$ (vapour).

How many moles of steam is obtained from 0.5 mol of O_2 used?

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55. Upon heating, baking soda (sodium hydrogen carbonate) decomposes according to the equation:

$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + H_2O(l) + CO_2(g)$

In an experiment, 8.4 g baking soda decomposes and carbon dioxide gas is collected.

Calculate the volume of carbon dioxide produced at NTP.

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56. Upon heating, baking soda (sodium hydrogen carbonate) decomposes according to the equation:

$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + H_2O(l) + CO_2(g)$

In an experiment, 8.4 g baking soda decomposes and carbon dioxide gas is collected.

How many moles of CO_2 are produced?

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57. Upon heating, baking soda (sodium hydrogen carbonate) decomposes according to the equation:

$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + H_2O(l) + CO_2(g)$

In an experiment, 8.4 g baking soda decomposes and carbon dioxide gas is collected.

What would be the volume of CO_2 measured at STP?

$(R.\ A.\ M.: Na = 23, H = 1, C = 12, O = 16)$

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58. When 1 mol of zinc was treated with sufficient quantity of hydrochloric acid, the whole of Zn was consumed. In the reaction, hydrogen gas was liberated and zinc chloride was formed. State The moles of HCl required to react with 1 mole of zinc.

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59. When 1 mol of zinc was treated with sufficient quantity of hydrochloric acid, the whole of Zn was consumed. In the reaction,

hydrogen gas was liberated and zinc chloride was formed. State

The moles of H_2 liberated.

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60. When 1 mol of zinc was treated with sufficient quantity of hydrochloric acid, the whole of Zn was consumed. In the reaction, hydrogen gas was liberated and zinc chloride was formed. State

The volume of H_2 at STP.

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61. When steam is passed over hot iron, hydrogen is liberated and Fe_3O_4 is formed according to the chemical equation $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2(g)$.

In a typical reaction, 56 g iron was consumed. Calculate the following:

The volume of H_2 liberated at STP (when molar volume of H_2 is $22.4L$)

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62. When steam is passed over hot iron, hydrogen is liberated and Fe_3O_4 is formed according to the chemical equation $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2(g)$.

In a typical reaction, 56 g iron was consumed. Calculate the following:

The mass of Fe_3O_4 formed.

$(R.\ A.\ M.: H = 1, O = 16, Fe = 56)$

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63. With the help of the equation $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$, calculate the

following :

The mass of $CaCl_2$ formed from $10gCaCO_3$.

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64. With the help of the equation $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$, calculate the following :

The volume of CO_2 formed at STP from 10 g $CaCO_3$.

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65. How many litres of NH3 would be formed when 120 L of H_2, at standard conditions combine with N_2? What is the volume of N_2 consumed in this reaction?

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66. What mass of oxygen is required to burn (1) 480 g of methane, (ii) $500cm^3$ of methane?

Equation: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Relative atomic mass: $C = 12, H = 1, O = 16$

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67. What is the mass of magnesium oxide (MgO) formed when 10 g of Mg is burnt?

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68. How many grams of potassium chlorate should be decomposed to liberate 9.6 g of oxygen?

Equation: $2KClO_3 \rightarrow 2KCl + 3O_2$

Relative atomic mass:$K = 39, Cl = 35.5, O = 16$

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69. How many grams of carbon dioxide is set free by the decomposition of 20 g of calcium carbonate?

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70. What would be the volume of this CO_2 at STP?

Equation :

$CaCO_3 \rightarrow CaO + CO_2(g)(R.A.M.: Ca = 40, C = 12, O = 16)$

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71. Compute the volume of oxygen needed for complete combustio fo 114g of octane (C_8H_{18}) at STP.

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72. What is the volume of O_2 needed to burn 60 L of octane at STP ?

Equaton $2C_6H_8 + 25O_2 \rightarrow 16CO_2 + 18H_2O$

R.A.N.:C=12,H=1,O=16

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73. How many gramsof oxygen is required to burn 40g or sulphur ?

Equation $S + O_2 \rightarrow SO_2 (R.\ A.\ M.\ : S = 32, O = 16)$

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74. In an experiment, a mixture of 8g CH_4 and $24gO_2$ was burn to form CO_2 and H_2O according to the equation

$: CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g) +$ heat

Which reactant in limiting reagent (small proportiona)?

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75. In an experiment, a mixture of 8g CH_4 and $24gO_2$ was burn to form CO_2 and H_2O according to the equation $: CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g) +$ heat

How many moles of CO_2 will be formed ?

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76. In an experiment, a mixture of 8g CH_4 and $24gO_2$ was burn to form CO_2 and H_2O according to the equation $: CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g) +$ heat

How many grams of CO_2 will be formed ?

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77. In an experiment, a mixture of 8g CH_4 and $24gO_2$ was burn to form CO_2 and H_2O according to the equation : $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g) +$ heat

How many moles of other reactant will remain unreacted after the reaction has stopped ?

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78. With the help of the balanced chemical equation

$2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

Answer the equations below :

How many moles of acid are required for each mole of H_2 liberated?

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79. With the help of the balanced chemical equation

$2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

Answer the equations below :

What would be the mass of $Al_2(SO_4)_3$ formed per 27 g Al consumed?

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80. With the help of the balanced chemical equation

$2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

Answer the equations below :

How much Al (in grams) will be used to liberate 22.4 L of Hydrogen gas, at STP

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81. With the help of the balanced chemical equation

$2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

Answer the equations below :

What will be the mass of H_2 produced per mole of Al consumed?

(R.A.M: Al = 27, H = 1, S = 32, O = 16)

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82. Hydrogen and oxygen combine to form water according to the following equation:

$2H_2 + O_2 \rightarrow 2H_2O$. A mixture of 22.4 L of H_2 and 22.4 L of O_2 at $100^\circ C$ is ignited.

Calculate the volume of steam produced.

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83. Hydrogen and oxygen combine to form water according to the following equation:

$2H_2 + O_2 \rightarrow 2H_2O$. A mixture of 22.4 L of H_2 and 22.4 L of O_2 at $100^\circ C$ is ignited.

What gas if any will be present on cooling to room temperature?

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84. Ammonia burns in oxygen as

$2NH_3(g) + 2.5O_2(g) \rightarrow 2NO(g) + 3H_2O(g)$

What mass of steam is produced when 1.5 g NO is formed?

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85. Ammonia burns in oxygen as

$2NH_3(g) + 2.5O_2(g) \rightarrow 2NO(g) + 3H_2O(g)$

What volume of O_2 at STP is required to produce 10 mol of products $(4NO + 6H_2O)$?

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86. Use equation $2H_2O(l) \rightarrow 2H_2(g)$ to answer the following

What volume of O_2 will be produced if the volume of H_2 produced is $2500cm^3$ under similar conditions?

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87. Use equation $2H_2O(l) \rightarrow 2H_2(g)$ to answer the following

What is the final volume of H_2 if the pressure is increased by 2.5 times at constant temperature?

Watch Video Solution

88. A sample of ammonium nitrate when heated yields 8.96 L of steam (measured at STP).

$NH_4NO_3 \rightarrow N_2O + 2H_2O$

What volume of dinitrogen oxide is produced at the same time as 8.96 L of steam?

Watch Video Solution

89. A sample of ammonium nitrate when heated yields 8.96 L of steam (measured at STP).

$NH_4NO_3 \rightarrow N_2O + 2H_2O$

What mass of ammonium nitrate should be heated to produce 8.96 L of steam?

(Relative molecular mass of ammonium nitrate is 80.)

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90. Determine the percentage of oxygen in ammonium nitrite

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91. Commerical sodium hydroxide weighing 30 g has some sodium chloride in it. The mixture on dissolving in water and subsequent treatment with excess silver nitrate solution formed a precipitate weighing 14.3 g. What is the percentage of sodium chloride in the commercial sample of sodium hydroxide? The equation for the reaction is

$NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$

(Relative molecular mass of $NaCl = 58$, $AgCl = 143$)

Watch Video Solution

92. The equations given below relate to the manufacture of sodium carbonate (molecular mass of Na $CO_3 = 106$).

$NaCl + NH_3 + CO_2 + H_2O \rightarrow NaHCO_3 + NH_4Cl$

$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

Question a and b are based on the production of 21.2 g of sodium carbonate

b. To produce the mass of sodium hydrogen carbonate calculated in (a) what volume of carbon dioxide measured at STP, would be required?

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93. The equations given below relate to the manufacture of sodium carbonate (molecular mass of

$NaCl + NH_3 + CO_2 + H_2O \rightarrow NaHCO_3 + NH_4Cl$

Na $CO_3 = 106$).

$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

Question a and b are based on the production of 21.2 g of sodium carbonate

a. What is the mass of sodium hydrogen carbonate must be heated to give 21.2 g of sodium carbonate (molecular weight of NaHCO_(3) = 84)

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94. A sample of 10 g of a mixture of sodium chloride and anhydrous sodium sulphate of dissolved in water. When an excess of barium chloride solution is added, 6.99 g of barium sulphate is precipitated according to the equation: $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NACl$. Calculate the percentage of sodium sulphate in the original mixture. (O = 16, Na = 23,S = 32, Ba = 137)

Watch Video Solution

95. From the equation :

$C + 2H_2SO_4 \rightarrow CO_2 + 2H_2O + 2SO_2$

Calculate :

The mass of carbon oxidised by 49 g of sulphuric acid (C = 12, relative molecular mass of sulphuric acid = 98)

Watch Video Solution

96. From the equation :

$C + 2H_2SO_4 \rightarrow CO_2 + 2H_2O + 2SO_2$

Calculate :

Calculate the volume of Sulfur dioxide that is released in the reaction when 24 grams of black carbon is used in the reaction.

Watch Video Solution

97. Given that the relative molecular mass of copper oxide is 80, what volume of ammonia (measured at STP) is required to completely reduce 120 g of copper oxide? The equation for the reaction is:

$3CuO + 2NH_3 \rightarrow 3Cu + 3H_2O + N_2$

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98. 560 mL of carbon monoxide is mixed with 500 mL of oxygen and ignited. The chemical equation for the reaction is $2CO + O_2 \rightarrow 2CO_2$.

Calculate the volume of oxygen used and carbon dioxide formed in the above reaction.

Watch Video Solution

99. How much calcium oxide is formed when 82 g of calcium nitrate is heated ? Also find the volume of nitrogen dioxide evolved :

$2Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 + O_2$

(Ca = 40, N = 14, O = 16)

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100. The equation $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$, represents the catalytic oxidation of ammonia. If 100 cm^3 of ammonia is used, calculate the volume of oxygen required to oxidise the ammonia completely.

Watch Video Solution

101. Concentrated nitric acid oxidises phosphorus to phosphoric acid according to the following equation:

$P + 5HNO_3(\text{conc.}) \rightarrow H_3PO_4 + H_2O + 5NO_2$

If 9.3 g of phosphorus was used in the reaction, calculate :

Number of moles of phosphorus taken.

Watch Video Solution

102. Concentrated nitric acid oxidises phosphorus to phosphoric acid according to the following equation:

$P + 5HNO_3(\text{conc.}) \rightarrow H_3PO_4 + H_2O + 5NO_2$

If 9.3 g of phosphorus was used in the reaction, calculate :

The mass of phosphoric acid formed.

Watch Video Solution

103. Concentrated nitric acid oxidises phosphorus to phosphoric acid according to the following equation:

$P + 5HNO_3(\text{conc.}) \rightarrow H_3PO_4 + H_2O + 5NO_2$

If 9.3 g of phosphorus was used in the reaction, calculate :

The volume of nitrogen dioxide produced at S.T.P.

[H = 1, N = 14, P = 31, O = 16]

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104. 67.2 litre of hydrogen combines with 44.8 litres of nitrogen to form ammonia under specific conditions as :

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

Calculate the volume of ammonia produced. What is the other substance, if any, that remains in the resultant mixture ?

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105. The mass of 5.6 dm^3 of a certain gas at S.T.P.is 12.0 g. Calculate the relative molecular mass of the gas.

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106. Complete the calculation. Show working for complete credit :

If 6 litre of hydrogen and 4 litre of chlorine are mixed and exploded and if water is added to the gases formed, find the volume of the residual gas

Watch Video Solution

107. Propane burns in air according to the following equation :

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O.$

What volume of propane is consumed on using 1000 cm^3 of air, considering only 20% of air contains oxygen ?

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108. Calculate the ratio of number of molecules in 10 L of O_2 and 10 L of N_2 at $25^\circ C$ and 1 atm. State the law used in the calculation

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109. Copy the following table which gives the volumes of gases collected under the same conditions of temperature and pressure and the number of molecules (X) in 20 litres of nitrogen. You are to complete the table giving the number of molecules in the other gases in terms of X.

Gas	Volume (litres)	Number of molecules
(*i*) Chlorine	10	
(*ii*) Nitrogen	20	X
(*iii*) Ammonia	20	
(*iv*) Oxygen	5	

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110. Hydrogen and chlorine combine to form hydrogen chloride gas.

What is the volume ratio of the gases? Name the law.

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111. Hydrogen and chlorine combine to form hydrogen chloride gas.

What is the molecule ratio of the gases? Name the law.

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112. Hydrogen and oxygen combine to form water vapour.

When 40 litres of hydrogen burn, how many litres of oxygen are used?

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113. Hydrogen and oxygen combine to form water vapour.

Calculate the ratio between the volume of hydrogen and volume of oxygen.

Watch Video Solution

114. Hydrogen and oxygen combine to form water vapour.

Name and state the law illustrated by this problem.

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115. How many litres of ammonia gas will be produced when one litre of nitrogen combines with three litres of hydrogen at a given temperature and pressure?

Watch Video Solution

116. Give two examples of gases with (1) atomicity = 2

Watch Video Solution

117. Give two examples of gases with and (ii) atomicity = 3

Watch Video Solution

118. Select monoatomic, diatomic and triatomic molecules from the following list:

$He, H_2, CO_2, HCI, NO, Ar, N_2, H_2O$

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119. A vessel contains X number of molecule of hydrogen gas at a certain temperature and pressure. How many molecules of oxygen

will be present in a vessel of same volume under the same conditions of temperature and pressure? Name the law to justify your answer.

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Questions For Practice Fill In The Blanks

1. A dozen of pencils is the collection of _____pencils.

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2. _____ is used to report the amount of chemical substance.

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3. What is the value of Avogadro's Number ?

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4. The number of moles of Cl atoms in one mole of CCl_4 _____ is

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5. The mass of 0.2 mol of carbon is_____ grams.

Watch Video Solution

6. The molar volume of a gas is _____ at STP

Watch Video Solution

7. The number of molecules in 32 g of oxygen is _____

Watch Video Solution

8. The number of moles in 36 g of hydrogen is ____

Watch Video Solution

9. Write the name and symbol of the reference element that has been used as a standard substance to define the relative atomic mass.

Watch Video Solution

10. What is the atomic mass and gram atomic mass of the standard reference element?

Watch Video Solution

Questions For Practice On Examination Pattern Section I

1. The amount of a chemical substance is reported as

A. mole

B. mass

C. volume

D. density

Answer: A

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2. The molar mass of O_2 is 32 g per mole. What is the number of moles in 16 g of oxygen?

A. 3.2

B. 0.5

C. 0.3125

D. 0.42

Answer: B

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3. One mole of N, represents which one of the following?

A. 28g of nitrogen

B. 22.4 L at STP

C. $6.022 \times 10^{23} N_2$, molecules

D. All the three

Answer: D

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4. Which one is not true about H_2SO_4?

A. It is composed of 2H, 1S and 4O atoms.

B. Its molar mass is 98 g/mol

C. It is composed of one molecule H_2 one atom S and two molecules O_2

D. its relative molecular mass is 98.

Answer: C

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Watch Video Solution

5. The number of moles in 16 g calcium is 0.4. What is the molar mass of Ca atoms?

A. $4gmol^{-1}$

B. $6.4gmol^{-1}$

C. $0.04gmol^{-1}$

D. $40gmol^{-1}$

Answer: D

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6. The molar mass of Ne atoms is $20gmol^{-1}$. What is the number of moles in 100 g of neon?

A. 5

B. 10

C. 200

D. 100

Answer: A

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7. Which one is the correct formula of aluminium sulphate?

A. $AlSO_4$

B. $Al_2(SO_4)_3$

C. $Al_3(SO_4)_2$

D. $Al(SO_4)_3$

Answer: B

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8. The molar mass of H_2O is 18 g moll. What is the number of moles in 90 g water?

A. 5

B. 11

C. 0.2

D. 72

Answer: A

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9. What is the ratio of the number of molecules in 14 g CO to that of 28 g N ?

A. 1.5

B. 2

C. 3.5

D. 0.5

Answer: D

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10. Which oen of the following has larger number of molecules ?

A. $11gCO_2$

B. $12gO_2$

C. $2gH_2$

D. $21gN_2$

Answer: C

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11. The mass of 0.4 mol Ar is 16 g. What is the molar mass of Ar atoms?

A. $4gmol^{-1}$

B. $6.4gmol^{-1}$

C. $0.04gmol^{-1}$

D. $40gmol^{-1}$

Answer: D

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12. A gas cylinder of capacity of $20dm^3$ is filled with gas X, the mass of which is 10g. When the same cylinder is filled with hydrogen gas at the same temperature and pressure, the mass of the hydrogen is 2g. Hence the relative molecular mass of the gas is

A. 5

B. 10

C. 15

D. 20

Answer: B

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13. The gas law relating volume with its number of molecules is called

A. Boyl's law

B. Gay-Lussac's law

C. Avogadro's law

D. Ohm's law

Answer: C

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14. In the reaction $N_2 + 3H_2 \rightarrow 2NH_3$, the volume ratio of the gases as 1: 3: 2 was

A. Boyle

B. Gay-Lussac's law

C. Avogadro

D. Charles

Answer: B

15. The relative molecular mass of a gas is 44. Therefore, its vapour density is

A. 44

B. 88

C. 22

D. 11

Answer: C

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16. Choose the most appropriate answer

Which of the following would weigh the least ?

A. 2 mole of nitrogen atoms

B. 1 mol of silver

C. 22.4 L of oxygen gas at STP

D. 6.02×10^{23} atoms of carbon

Answer: D

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17. Select odd one out from the following and justify your answer.

$C_2H_6, H_2O_2, C_6H_6, H_2O$

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18. Select odd one out from the following and justify your answer.

$NaCl, NaHCO_3, NH_3, H_2O_2$

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19. Select odd one out from the following and justify your answer.

He, H_2, N_2, O_2

Watch Video Solution

20. Select odd one out from the following and justify your answer.

He, Ar, CO, Ne

Watch Video Solution

21. Select odd one out from the following and justify your answer.

HCl, CO_2, H_2S, SO_2

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22. Match (A) mole, (B) Avogadro's number, (C) 22.4 L, (D) vapour density, (E) empirical formula with its description given below.

It is equal to half of the molecular mass

Watch Video Solution

23. Match (A) mole, (B) Avogadro's number, (C) 22.4 L, (D) vapour density, (E) empirical formula with its description given below.

It is the volume of one mole of a gas at STP.

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24. Match (A) mole, (B) Avogadro's number, (C) 22.4 L, (D) vapour density, (E) empirical formula with its description in (1)-(v) given below.

Its numerical value is 6.022×10^{23}

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25. Match (A) mole, (B) Avogadro's number, (C) 22.4 L, (D) vapour density, (E) empirical formula with its description in (1)-(v) given below.

I represents the simple ratio of atoms in a molecule.

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26. Match (A) mole, (B) Avogadro's number, (C) 22.4 L, (D) vapour density, (E) empirical formula with its description in (1)-(v) given

below.

Its numerical value is 6.022×10^{23}

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27. The volumes of gases A, B, C and D are in the ratio, 1:2:2:4 under the same conditions of temperature and pressure.

Which sample of gas contains the maximum number of molecules?

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28. The volumes of gases A, B, C and D are in the ratio, 1:2:2:4 under the same conditions of temperature and pressure.

If the temperature and the pressure of gas A are kept constant, then what will happen to its volume when the number of molecules is doubled?

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29. The volumes of gases A, B, C and D are in the ratio, 1:2:2:4 under the same conditions of temperature and pressure.

If this ratio of gas volumes refers to the reactants and products of a reaction, which gas law is being observed?

Watch Video Solution

30. The volumes of gases A, B, C and D are in the ratio, 1:2:2:4 under the same conditions of temperature and pressure.

If the volume of A is actually 5.6 dm at STP, calculate the number of molecules in the actual volume of D at STP (Avogadro's number is 6×10^{23})

Watch Video Solution

31. The volumes of gases A, B, C and D are in the ratio, 1:2:2:4 under the same conditions of temperature and pressure. If the volume of A is actuaally 5.6 dm3 at s.t.p calculate the number of molecules in the actual volume of D ate s.t.p

Using your answer from (iv), state the mass of D if the gas is dinitrogen oxide (N_2O)

. (N = 14, O = 16)

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Questions For Practice On Examination Pattern Numericals

1. A sample of 10 g of a mixture of sodium chloride and anhydrous sodium sulphate of dissolved in water. When an excess of barium chloride solution is added, 6.99 g of barium sulphate is precipitated according to the equation:

$Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NACl$. Calculate the percentage of sodium sulphate in the original mixture. (O = 16, Na = 23,S = 32, Ba = 137)

Watch Video Solution

2. What volume of oxygen is required to burn completely a mixture of 22.4 L of methane and 11.2 L of hydrogen into carbon dioxide and steam? Equations of the reactions are given below. (Assume that all volumes are measured at STP.)

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

$2H_2 + O_2 \rightarrow 2H_2O$

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3. Consider the reaction and based on the reaction answer the questions that follow :

$(NH_4)_2Cr_2O_7 \xrightarrow{\text{Heat}} N_{2(g)} + 4H_2O(g) + Cr_2O_3$

Calculate:

The quantity in moles of nitrogen formed when 63g of $(NH_4)_2Cr_2O_7$ is given

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4. When excess lead nitrate solution was added to a solution of sodium sulphate, 15.15 g of lead sulphate was precipitated. What mass of sodium sulphate was present in the original solution?

$Na_2SO_4 + Pb(NO_3)_2 \rightarrow PbSO_4 + 2NaNO_3$

(O=16,Na=23,S=32,Pb=207)

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5. If $112cm^3$ of hydrogen sulphide is mixed with $120cm^3$ of chlorine at STP, what is the mass of sulphur formed according to the

equation $H_2S + Cl_2 \rightarrow 2HCl + S$?

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6. The reaction $4N_2O + CH_4 \rightarrow CO_2 + 2H_2O + 4N_2$ takes place in the gaseous state. If all volumes are measured at the same temperature and pressure, calculate the volume of dinitrogen oxide (N_2O) required to give 150 ml of steam. (N = 14, O = 16, C = 12, H = 1)

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7. Washing soda has the formula $Na_2CO_2.10H_2O$. What is mass of anhydrous sodium carbonate left when all the water of crystallisation is expelled by heating 57.2 g of washing soda?

Watch Video Solution

8. Calculate the volue of O_2 at 1 atm and 273 K required for the complete combustion of 2.64 L of acetylene (C_2H_2) at 1 atm and 273 K. $2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(l)$

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9. LPG stands for liquefied petroleum gas. Varieties of LPG are marketed including a mixture of propane (60%) and butane (40%). If 10 L of this mixture is burnt, find the total volume of carbon dioxide gas added to the atmosphere. Combustion reactions can be represented as:

$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$

$2C_4H_{10} + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(g)$

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Important Numerical Exercises

1. Compute the relative molecular mass (M), gram molecular mass and molar mass of sugar $(C_{12}H_{22}O_{11})$.

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2. How many molecules are there in 22.4 L of H_2 at STP?

Watch Video Solution

3. What is the mass of 11.2 L of N_2 at STP?

Watch Video Solution

4. The vapour density of carbon dioxide is 22. What is its gram molecular mass?

Watch Video Solution

5. Atomic mass of chlorine is 35.5. What is its vapour density?

Watch Video Solution

6. Which one in each of the following sets will occupy more volume at STP?

$2gH_2$ or $16gO_2$

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7. Which one in each of the following sets will occupy more volume at STP?

1 mole N_2 or $14gN_2$

Watch Video Solution

8. Which one in each of the following sets will occupy more volume at STP?

$22gCO_2$ or $20gO_2$

Watch Video Solution

9. Which one in each of the following sets will occupy more volume at STP?

$10gH_2 100gCO_2$

Watch Video Solution

10. Calculate the mass of each of the following at STP:

$5.6LO_2$

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11. Calculate the mass of each of the following at STP:

$11.2LCO_2$

Watch Video Solution

12. Calculate the mass of each of the following at STP:

$5.6LN_2$

Watch Video Solution

13. Calculate the mass of each of the following at STP:

$22.4LH_2$

Watch Video Solution

14. Calculate the mass of each of the following at STP:

$112 L Cl_2$

Watch Video Solution

15. Calculate the volume occupied by 15 g of a gas at STP. Its relative molecular mass is 60.

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16. What is the volume of 7.1 g Cl_2 at STP?

Watch Video Solution

17. Calculate the ratio of the number of molecules in 2 L of oxygen and 8 L of nitrogen at STP.

Watch Video Solution

18. Find the ratio of the number of moles in 2 g of oxygen and 8 g nitrogen.

Watch Video Solution

19. The ratio of the mass of a sulphur atom to that of an oxygen atom is 2:1. If the molar mass of O atoms is $16 g mol^{-1}$ find the mass of one mole of S atoms

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20. Compute the number of O atoms in 54 g of water. $M(H_2O) = 18g$.

Watch Video Solution

21. A vessel contains 5.6 g of nitrogen (N_2) gas. Calculate the following quantities. The molar mass of $N_2 is 28 g mol^{-1}$.

Number of moles of N_2

Watch Video Solution

22. A vessel contains 5.6 g of nitrogen (N_2) gas. Calculate the following quantities. The molar mass of $N_2 is 28 g mol^{-1}$.

Number of N_2 molecules

Watch Video Solution

23. A vessel contains 5.6 g of nitrogen (N_2) gas. Calculate the following quantities. The molar mass of $N_2 is 28 g mol^{-1}$.

Number of moles of N_2

Watch Video Solution

24. A vessel contains 5.6 g of nitrogen (N_2) gas. Calculate the following quantities. The molar mass of $N_2 is 28 g mol^{-1}$.

Volume of the gas at STP

Watch Video Solution

25. A gas cylinder contains 24×10^{24} molecules of nitrogen gas. If Avogadro's number is 6×10^{23} and the relative atomic mass of nitrogen is 14, calculate:

Mass of nitrogen gas in the cylinder.

Watch Video Solution

26. A gas cylinder contains 24×10^{24} molecules of nitrogen gas. If Avogadro's number is 6×10^{23} and the relative atomic mass of nitrogen is 14, calculate:

Volume of nitrogen at STP in dm.

Watch Video Solution

27. A certain gas 'X' occupies a volume of $100cm^3$ at STP and weighs 0.5 g. Find its relati ve molecular mass.

Watch Video Solution

28. Calculate the number of moles and the number of molecules present in 1.4 g of ethane (C_2H_4) gas. What is the volume occupied by the same amount of ethene?

Watch Video Solution

29. Calculate the vapour density of ethene. (C = 12, H = 1).

Watch Video Solution

30. A gas cylinder contains 12×10^{24} molecules of oxygen gas.

If Avogadro's number is 6×10^{23}. Calculate :

The mass of oxygen present in the cylinder.

Watch Video Solution

31. A gas cylinder contains 12×10^{24} molecules of oxygen gas.

If Avogadro's number is 6×10^{23}. Calculate :

The volume of oxygen at S.T.P. present in the cylinder. [O = 16]

Watch Video Solution

32. A cylinder contains 68 g of ammonia at STP.

How many moles of ammonia are present in this cylinder?

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33. A cylinder contains 68 g of ammonia at STP.

What is the volume occupied by this gas?

Watch Video Solution

34. A cylinder contains 68 g of ammonia at STP.

How many molecules of ammonia are present in the cylinder?

Watch Video Solution

35. A gas cylinder can hold 1 kg of hydrogen at room temperature and pressure :

Find the number of moles of hydrogen present.

Watch Video Solution

36. A gas cylinder can hold 1 kg of hydrogen at room temperature and pressure :

What weight of CO_2 can the cylinder hold under similar conditions of temperature and pressure ? (H=1, C = 12, O=16)

Watch Video Solution

37. A gas cylinder can hold 1 kg of hydrogen at room temperature and pressure :

If the number of molecules of hydrogen in the cylinder is X,

calculate the number of CO_2 molecules in the cylinder under the same conditions of temperature and pressure.

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Illustrative Assignments On Molecular Formula

1. A compound is composed of 74% C, 8.7% H and 17.3% N by mass. If the molecular mass of the compound is 162, what is its molecular formula? (R.A.M.: H = 1, C = 12, N = 14.)

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2. A compound is composed of 2.7% of H, 48.3% of CI and 49% of C atoms by mass. Determine its empirical formula. If the vapour density of the compound is 73.5, what is its molecular formula? (R.A.M.: H = 1, C = 12, CI = 35.5.)

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3. The percentage composition of sodium phosphate as determined by analysis is 42.1% sodium, 18.9% phosphorus and 39% oxygen. Find the empirical formula of the compound (work to two decimal places). (R.A.M: Na = 23, P = 31, O = 16.)

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4. A metal M forms a volatile chloride containing 65.5% chlorine. If the vapour density of the metal chloride is 162.5, find the molecular formula of the chloride. (M = 56, Cl = 35.5)

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5. 112 cm^3 at S.T.P. of a gaseous fluoride of phosphorus has a mass of 0.63 g calculate the relative molecular mass of fluoride. If the molecule of the fluoride contains only one atom of phosphorus, determine the formula of the phosphorus fluoride. [F = 19, P = 31]

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6. Determine the empirical formula of a compound containing 47.9% potassium, 5.5% beryllium and 46.6% fluorine by mass. (Atomic weight of Be=9, F = 19, K = 39).

Watch Video Solution

Illustrative Assignments

1. From the equation $4HCl + O_2 \rightarrow 2H_2O + 2Cl_2$, compute the moles of HCl needed to form $0.35 \text{ mol } Cl_2$.

Watch Video Solution

2. Compute the moles of Cl_2 produced from 3.2 mol HCl as per equation :

$16HCl + 2KMnO_4 \rightarrow 2MnCl_2 + 2KCl + 8H_2O + 5Cl_2$

Watch Video Solution

3. Compute the moles of K_3PO_4 needed to produce to produce 0.066 mol KCl as per equation:

$3CaCl_2 + 2K_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6KCl$

Watch Video Solution

4. Compute the mass of oxygen gas that will combine with 8 g of methane as per the chemical equation $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$. $(R.\ A.\ M.: H = 1, O = 16, C = 12.)$

Watch Video Solution

5. Compute the mass of potassium chlorate $(KClO_3)$ that should decompose to produce 8 g of oxygen as per the chemical equation , $2KClO_3 \rightarrow 2KCl + 3O_2(g)$

(R.A.M : K = 39, Cl = 35.5, $O = 16$.)

Watch Video Solution

6. Compute the volume of carbon dioxide formed when 8 g methane gas burns completely as represented by the equation :

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

Watch Video Solution

7. Compute the volume of methane gas that must be burnt completely to produce 100 L of CO_2 at STP.

Watch Video Solution

8. Ammonia and oxygen combine to produce water vapour and nitric oxide as per the chemical equation: $4NH_3(g) + 5O_2(g) \rightarrow 6H_2O(g) + 4NO$.

(ii) How many moles of oxygen are required to burn 85 g of ammonia?

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9. Ammonia and oxygen combine to produce water vapour and nitric oxide as per the chemical equation: $4NH_3(g) + 5O_2(g) \rightarrow 6H_2O(g) + 4NO.$

(ii) How many moles of oxygen are required to burn 85 g of ammonia?

Watch Video Solution

10. Ammonia and oxygen combine to produce water vapour and nitric oxide as per the chemical equation: $4NH_3(g) + 5O_2(g) \rightarrow 6H_2O(g) + 4NO.$

(ii) How many moles of oxygen are required to burn 85 g of ammonia?

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11. Ammonia and oxygen combine to produce water vapour and nitric oxide as per the chemical equation: $4NH_3(g) + 5O_2(g) \rightarrow 6H_2O(g) + 4NO$.

(iv) What is the volume of NH_3 at STP that will combine with oxygen in reaction (ii)?

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12. Carbon burns in oxygen as shown by the chemical equation: $2C(s) + O_2(g) \rightarrow 2CO(g)$.

A reaction is carried out starting with 12 g carbon and 48 g oxygen. Which reactant will be in excess at the end of the reaction?

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13. Carbon burns in oxygen as shown by the chemical equation: $2C(s) + O_2(g) \rightarrow 2CO(g)$.

A reaction is carried out starting with 12 g carbon and 48 g oxygen.

How many moles of CO will be produced?

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14. Carbon burns in oxygen as shown by the chemical equation: $2C(s) + O_2(g) \rightarrow 2CO(g)$.

A reaction is carried out starting with 12 g carbon and 48 g oxygen.

How many grams of CO will be produced?

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15. Carbon burns in oxygen as shown by the chemical equation: $2C(s) + O_2(g) \rightarrow 2CO(g)$.

A reaction is carried out starting with 12 g carbon and 48 g oxygen. What mass of the limiting reactant should be taken so that the end product is only CO?

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16. Calculate the volume of oxygen required for the complete combustion of 8.8 g of propane (C_3H_8). (Atomic mass : C = 14, O = 16, H = 1, Molar Volume = 22.4 dm^3 at S.T.P).

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17. In an experiment,4.5 mol of calcium carbonate are reacted with dilute hydrochloric acid.

Write the equation for the reaction.

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18. In an experiment,4.5 mol of calcium carbonate are reacted with dilute hydrochloric acid.

What is the mass of4.5 mol of calcium carbonate? (Relative molecular mass of calcium carbonate is 100.)

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19. In an experiment,4.5 mol of calcium carbonate are reacted with dilute hydrochloric acid.

What is the volume of carbon dioxide liberated at STP?

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20. In an experiment,4.5 mol of calcium carbonate are reacted with dilute hydrochloric acid.

What mass of calcium chloride is formed? (Relative molecular mass of calcium chloride is 111.)

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21. In an experiment, 4.5 mol of calcium carbonate are reacted with dilute hydrochloric acid.

How many moles of HCI are used in this reaction?

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22. Consider the reaction and based on the reaction answer the questions that follow :

$$(NH_4)_2Cr_2O_7 \xrightarrow{\text{Heat}} N_{2(g)} + 4H_2O(g) + Cr_2O_3$$

Calculate:

The quantity in moles of $(NH_4)_2Cr_2O_7$ if 63 gm of $(NH_4)_2Cr_2O_7$ is heated.

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23. Consider the reaction and based on the reaction answer the questions that follow :

$(NH_4)_2Cr_2O_7 \xrightarrow{\text{Heat}} N_{2(g)} + 4H_2O(g) + Cr_2O_3$

Calculate:

The quantity in moles of nitrogen formed when 63g of $(NH_4)_2Cr_2O_7$ is given

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24. Consider the reaction and based on the reaction answer the questions that follow :

$(NH_4)_2Cr_2O_7 \xrightarrow{\text{Heat}} N_{2(g)} + 4H_2O(g) + Cr_2O_3$

Calculate:

The volume in litres or dm of N_2 evolved at S.T.P

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25. Consider the reaction and based on the reaction answer the questions that follow :

$(NH_4)_2Cr_2O_7 \xrightarrow{\text{Heat}} N_{2(g)} + 4H_2O(g) + Cr_2O_3$

Calculate:

The mass in gram of Cr_2O_3 formed at the same time.

[Atomic masses : H = 1, Cr = 52, N = 14]

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26. Calculate the volume of oxygen required for complete burning of $90 \ \ \mathrm{dm}^3$ of butane

$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

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27. O_2 is evolved by heating $KClO_3$ using MnO_2 as a catalyst

$2KClO_3 \xrightarrow{MnO_2} 2KCl + 3O_2$

Calculate the mass of $KClO_3$ required to produce 6.72 litre of O_2 at S.T.P. [atomic masses of K = 39, Cl = 35.5, O = 16).

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28. O_2 is evolved by heating $KClO_3$ using MnO_2 as a catalyst

$2KClO_3 \xrightarrow{MnO_2} 2KCl + 3O_2$

Calculate the volume occupied by 0.01 mole of O_2 at S.T.P.

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