CHEMISTRY

NCERT - NCERT CHEMISTRY(TELUGU)

CHEMICAL CALCULATION

Solved Problem

1. Calculate the formula weight of each of the following to three significant figures, using a table of atomic weight (AW): (a) chloroform $CHCl_3(b)$ Iron (III) sulfate , $Fe_2(SO_4)_3$.

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2. What is the mass in grams of a chlorine atom, Cl?

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3. What is the mass in grams of a hydrogen chloride, HCl?

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4. ZnI_2, can be prepared by the direct combination of elements. A chemist determines from the amounts of elements that 0.0654 mol ZnI_2 can be formed.

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5. How many molecules are there in a 3.46 g sample of hydrogen chloride, HCl?

Note: The number of molecules in a sample is related to moles of compound (1 mol HCl $= 6.023 \times 10^{23}$ HCl molecules). Therefore if

you first convert grams HCl to moles, then you can convert moles to number of molecules).

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6. A compound has the following composition Mg = 9.76%,S = 13.01%, 0 = 26.01, H_2O = 51.22, what is its empirical formula? [Mg = 24, S = 32, O = 16, H = 1]

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7. A compound on analysis gave the following percentage composition C = 54.54%, H, 9.09% 0 = 36.36. The vapour density of the compound was found to be 44. Find out the molecular formula of the compound.

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8. A compound on analysis gave the following percentage composition: Na=14.31% S = 9.97%, H = 6.22%, O = 69.5%, calcualte the molecular formula of the compound on the assumption that all the hydrogen in the compound is present in combination with oxygen as water of crystallisation. Molecular mass of the compound is 322 [Na = 23, S = 32, H = 1, 0 = 16].

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9. Identify the oxidising agent, reducing agent, substance oxidised and substance reduced in the following reactions.

$$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$$

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10. 4.5g of urea (molar mass = 60g mol^{-1}) are dissolved in water and solution is made to 100 ml in a volumetric flask. Calculate the molarity of solution.

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11. Calculate the normality of solution containing 3.15 g of hydrated oxalic acid $(H_2C_2O_4.2H_2O)$ in 250 ml of solution (Mol. Mass = 126).

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12. Calculate the molality of an aqueous solution containing 3.0g of urea (mol.mass=60) in 250g of water.

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13. What volume of 6M HCl and 2M HCl should be mixed to get one litre of 3M HCl?

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14. How much volume of 10M HCl should be diluted with water to prepare 2.00L of 5M HCl.

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Problem

1. Calculate the oxidation number of underlined elements in the following species.

$\underline{C}O_2, \underline{Cr_2}O_7^{2-}, \underline{Pb_3}O_4, \underline{P}O_4^{3-}$

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2. 0.548 g of the metal reacts with dilute acid and liberates 0.0198 g of hydrogen at S.T.P. Calculate the equivalent mass of the metal.

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3. 0.635 g of a metal gives on oxidation 0.795g g of its oxide. Calculate the equivalent mass of the metal.

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4. In the determination of molecular mass by Victor - Meyer's Method 0.790 g of a volatile liquid displaced $1.696 \times 10^{-4} m^3$ of moist air at 303 K and at $1 \times 10^5 Nm^{-2}$ pressure. Aqueous tension at 303 K is $4.242 \times 10^3 Nm^{-2}$. Calculate the molecular mass and vapour density of the compound .

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Example

1. Calculate the mass of CO_2 that would be obtained by completely dissolving 10 kg of pure $CaCO_3$ in HCl.

$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

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2. Calculate the mass of oxygen obtained by complete decomposition of 10kg of pure potassium chlorate (Atomic mass K=39, O=16 and Cl = 35.5)

$2KClO_3 \rightarrow 2KCl + 3O_2$

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3. Calculate the mass of lime that can be prepared by heating 200 kg of limestone that is 90% pure $CaCO_3$

$CaCO_3 \rightarrow CaO + CO_2$

$100kg \times 10^{-3}$ $56kg \times 10^{-3}$

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Problems Of Practice

1. Calculate the formula weight of compounds NO_2

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2. Calculate the formula weight of compounds glucose $(C_6H_{12}O_6)$

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3. Calculate the formula weight of compounds NaOH

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4. Calculate the formula weight of compounds Mg $(OH)_2$

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5. Calculate the formula weight of compounds methanol (CH_3OH)

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6. Calculate the formula weight of compounds PCl_3

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7. Calculate the formula weight of compounds K_2CO_3

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8. What is the mass in grams of a calcium atom, Ca?

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9. What is mass in grams of an ethanol molecule, C_2H_5OH ?

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10. Calcualte the mass (in grams) of each of the following species.

a. Na atom b. S atom c. CH_3Cl molecule d. Na_2SO_3 formula unit

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11. H_2O_2 is a colourless liquid. A concentrated solution of it is used as a source of oxygen for Rocket propellant fuels. Dilute aqueous solutions are used as a bleach. Analysis of a solution shows that it contains 0.909 mol H_2O_2 in 1.00 L of solution. What is the mass of H_2O_2 in this volume of solution?.

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12. Boric acid, H_3BO_3 is a mild antiseptic and is often used as an eye wash. A sample contains 0.543 mol H_3BO_3. What is the mass of boric acid in the sample?.

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13. CS_2 is a colourless, highly inflammable liquid used in the manufacture of rayon and cellophane. A sample contains 0.0205

mol CS_2. Calculate the mass of CS_2 in the sample.

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14. Nitric acid, HNO_3 is a colourless, corrosive liquid used in the manufacture of Nitrogen fertilizers and explosives. In an experiment to develop new explosives for mining operations, a 28.5 g sample of HNO_3 was poured into a beaker. How many moles of HNO_3 are there in this sample of HNO_3?

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15. Obtain the moles of substances in the following.

a. 3.43 g of C b. 7.05 g Br_2

c. 76 g C_4H_{10} d. 35.4 g Li_2CO_3

e. 2.57 g As f. 7.83 g P_4

$41.4gN_2H_4$ h. 153 g $Al_2(SO_4)_3$

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16. How many molecules are there in 56 mg HCN ?

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17. Calculate the following

Number of molecules in 43 g NH_3

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18. Calculate the following

Number of atoms in 32.0 g Br_2

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19. Calculate the following

Number of atoms in 7.46 g Li

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20. A substance on analysis, gave the following percentage composition, Na = 43.4%, C = 11.3%, 0 = 43.3% calculate its empirical formula [Na = 23, C = 12, O = 16].

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21. What is the simplest formula of the compound which has the following percentage composition: Carbon 80%, hydrogen 20%.

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22. A compound on analysis gave the following percentage composition: C - 54.54%, H = 9.09%, 0 = 36.36%

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23. An organic compound was found to have contained carbon = 40.65%, hydrogen = 8.55% and Nitrogen = 23.7%. Its vapour - density was found to be 29.5. What is the molecular formula of the compound?

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24. A compound contains 32% carbon, 4% hydrogen and rest oxygen. Its vapour density is 75. Calculate the empirical and molecular formula.

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25. An acid of molecular mass 104 contains 34.6% carbon, 3.85% hydrogen and the rest is oxygen. Calcualte the molecualr formula of the acid.

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26. What is the simplest formula of the compound which has the following percentage composition: carbon 80%, Hydrogen 20%, If the molecular mass is 30, calcualte its molecular formula.

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27. Calculate the oxidation number of underlined elements in the following species.

$\underline{Mn}SO_4$

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28. Calculate the oxidation number of underlined elements in the following species.

$\underline{S_2}O_3$

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29. Calculate the oxidation number of underlined elements in the following species.

$H\underline{N}O_3$

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30. Calculate the oxidation number of underlined elements in the following species.

$K_2\underline{Mn}O_4$

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31. Calculate the oxidation number of underlined elements in the following species.

$\underline{N}H_4^+$

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32. Balance the equations $Mg + NO_3^- \rightarrow Mg^{2+} + N_2O + H_2O)$ (in acidic medium)

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33. Balance the equations $Cr^{3+} + Na_2O_2 \rightarrow CrO_4^- + Na^+$

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34. Balance the equations $S^{2-} + NO_3^- \rightarrow NO + S$

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35. Balance the equations $FeS + O_2 \rightarrow Fe_2O_3 + SO_2$(molecular form)

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36. In the reaction : $Cl_2 + OH^- \rightarrow Cl^- + ClO_4^- + H_2O$ chlorine is :

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37. Calculate the volume of 14.3m NH3, solution needed to prepare 1L of 0.1M solution.

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38. How would you make up 425 mL of 0.150M HNO_3 from 68.0% HNO_3? The density of 68.0% HNO_3 is1.41g/mL.

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39. Calculate the molarity of a solution obtained by mixing 100 mL of 0.3 M H_2SO_4 and 200 mL of 1.5M H_2SO_4

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40. Calculate the molality of a solution by dissolving 0.850g of ammonia (NH_3) in 100g of water.

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41. $NiSO_4$ reacts with Na_3PO_4 to give a yellow green precipitate of $Ni_3(PO_4)_2$ and a solution of Na_2SO_4.

$3NiSO_4(aq) + 2Na_3PO_4(aq) \rightarrow Ni_3(PO_4)_2(s) + 3Na_2SO_4(aq)$

How many mL of 0.375 M $NiSO_4$ will react with 45.7 mL of $0.265M$ Na_3PO_4 ?

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42. What volume of 0.250 M HNO_3 reacts with 42.4 mL of 0.150 M Na_2CO_3 in the following reaction ?

$2HNO_{3(aq)} + Na_2CO_{3(aq)} \rightarrow 2NaNO_{3(aq)} + H_2O_{(aq)} + CO_{2(aq)}$

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43. A flask contains 53.1 mL of 0.0150 M $Ca(OH)_2$ solution. How many mL of 0.350 M Na_2CO_3 are required to react completely with $Ca(OH)_2$ in the following reaction .

$$Na_2CO_{3\,(aq)} + Ca(OH)_{2\,(aq)} \rightarrow CaCO_{3\,(aq)} + 2NaOH_{(aq)}$$

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Question Choose The Best Answer

1. The volume occupied by 16g of oxygen at S.T.P.

A. 22.4L

B. 44.8 L

C. 11.2L

D. 5.6L

Answer:

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2. Avogadaro's number represents the number of atoms in

A. 12 g of C^{12}

B. 320 g of S

C. 32 g of Oxygen

D. 12.7 g of iodine.

Answer:

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3. The value of gram molecular volume of ozone at S.T.P is

A. 22.4 L

B. 2.24 L

C. 11.2 L

D. 67.2 L

Answer:

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4. The number of atoms present in 0.5 gram- atoms of Nitrogen is same as the atoms in

A. 12g of C

B. 32g of S

C. 8g of the oxygen

D. 24g of magnesium

Answer:

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5. The number of gram-atoms of oxygen in 128g of oxygen is

A. 4

B. 8

C. 128

D. $8 \times 6.02 \times 10^{23}$

Answer:

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6. The total number of moles present in 111g of $CaCl_2$ is

A. One mole

B. Two moles

C. Three moles

D. Four moles

Answer:

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7. Which of the following weighs the most?

A. One gram-atom of nitrogen

B. One mole of water

C. One mole of Sodium

D. One molecule of H_2SO_4

Answer:

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8. Which of the following contains same number of carbon atoms as are in 6.0g of carbon (C-12)?

A. 6.0g ethane

B. 8.0g methane

C. 21.0g Propane

D. 28.0g CO

Answer:

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9. Which of the following contains maximum number of atoms?

A. 2.0g hydrogen

B. 2.0g oxygen

C. 2.0g nitrogen

D. 2.0g methane

Answer:

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10. Which one among the following is the standard for atomic mass?

A. H

B. $^{12}C_6$

C. $^{14}C_6$

D. $^{16}O_8$

Answer:

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11. Which of the following pair of species have same number of atoms under similar conditions ?

A. 1L of each of SO_2 and CO_2

B. 2L each of O_3 and O_2

C. 1L each of NH_3 and Cl_2

D. 1L each of NH_3 and $2L$ of SO_2

Answer:

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12. 2.0 g of oxygen contain number of atoms same as in

A. 4g of S

B. 7g of nitrogen

C. 0.5 g of H_2

D. 12.3 g of Na

Answer:

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13. The number of gm-molecules of oxygen in 6.02×10^{24} CO molecules is

A. 1 gm-molecule

B. 0.5 gm-molecule

C. 5 gm-molecule

D. 10 gm-molecule

Answer:

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14. Hydrogen phosphate of certain metal has a formula $MHPO_4$, the formula of metal chloride is

A. MCl

B. MCl_3

C. MCl_2

D. MCl_4

Answer:

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15. A compound contains 50% of X (atomic mass 10) and 50% Y (at. mass 20). Which formula is certain to above data ?

A. XY

B. X_2Y

C. X_4Y_3

D. $(X_2)_3Y_3$

Answer:

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16. Which of the following compound has / have percentage of carbon same as that in ethylene (C_2H_4) ?

A. propene

B. Cyclohexane

C. Ethyne

D. Benzene

Answer:

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17. 5L of 0.1 M solution of sodium Carbonate contains

A. 53g of Na_2CO_3

B. 106 g of Na_2CO_3

C. 10.6 of Na_2CO_3

D. 5×10^2 millimoles of Na_2CO_3

Answer:

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Question Fill In The Blanks

1. One mole of a triatomic gas contains _____ atoms.

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2. One mole of Sulphuric acid contains _____ Oxygen atoms.

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3. 11.2 L of carbon dioxide at S.T.P contains _____ oxygen atoms.

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4. Equal volumes of different gases under similar conditions of temperature and pressure contain equal number of _____

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5. A decimolar solution of NaOH contains _____ of NaOH per litre of the solution.

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6. 7 g of CO contains _____ O atoms.

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7. The mass of 1×10^{22} formula units of $CuSO_4.5H_2O$ is _____

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Question Match The Following

1. Match the following

Column A		Column B
1. CaC_2	a.	106 g
2. Law of multiple proportions	b.	6.02×10^{23} Ne atoms
3. Hydrargyrum	c.	Molarity of solution
4. 2 gm-equivalents of Na_2CO_3	d.	0.01 moles of solute in one L of solution
5. 22.4 L at S.T.P	e.	Liquid element
6. Number of gm-molecules per litre of solution	f.	Calcium carbide
7. 1 gm-atom of rhombic sulphur	g.	$(NH_4)_2SO_4.Fe(SO_4).6H_2O$
8. Centimolar solution	h.	1/8 gm-molecules
9. Mohr's Salt	i.	John Dalton

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Question Answer The Following

1. Can two different compounds have same molecular formula ? Illustrate your answer with two examples.

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2. What are the essentials of a chemical equation ?

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3. What are the informations conveyed by a chemical equation ?

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4. Balance the following equations

$Fe + H_2O \rightarrow Fe_3O_4 + H_2$

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5. Balance the following equations

$$Fe_2(SO_4)_3 + NH_3 + H_2O \rightarrow Fe(OH)_3 + (NH_4)_2SO_4$$

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6. Balance the following equations

$$KMnO_4 + H_2SO_4 \rightarrow K_2SO_4 + MnSO_4 + H_2O + O_2$$

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7. Balance the following equations

$$K_2Cr_2O_7 + H_2SO_4 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O + O_2$$

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