CHEMISTRY

BOOKS - CENGAGE CHEMISTRY

EQUIVALENT MASS

Examples

1. When 0.30 g of a metal is dissolved in excess mass of dilute hydrochloric acid, 280 cm^3 of

hydrogen is liberated at STP. Calculate the equivalent mass of the metal.

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2. An oxide of a metal contains 75% of the metal. Calculate its equivalent mass.

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3. About 0.54 g silver is dissolved in nitric acid. The resulting silver nitrate in converted into

0.7175 g silver chloride by the addition of common salt. Calculate the equivalent mass of silver.

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4. 1.08 g of copper displaces 3.67 g of silver from a solution of silver nitrate. Find the equivalent mass of copper.(equivalent mass of silver = 108)

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5. 7.95 g of a cupric oxide is obtained by oxidising 6.35 g of copper 0.318 g of copper is displaced by 0.327 g of zinc from copper sulphate solution. Find the equivalent masses of copper and zinc.

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Worked Examples

1. 2 g of sodium hydroxide is dissolved in water to get 100 cm^3 of the solution. Calculate the

normality of the solution.

(Equivalent mass E of NaOH = 40)

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2. 1.176 g of sulphuric acid is present in 200 m

of its solution. Calculate the normality of the

solution.

(Equivalent mass of sulphuric acid = 49)

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3. 19.6 g of Mohr's salt is dissolved in 2.5 L solution. Calculate the nnormality of the solutuion.

(Equivalent mass of Mohr's salt = 392)

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4. 3.15 g of dibasic acid is present in 500 mL of its 0.1 N solution. Calculate the molecular mass of the acid.

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5. Calculate the mass of solution carbonate required to prepare 250 mL decinormal solution.

6. Calculate the molarity of the solutino containing 4.9 g sulphuric acid in 1 L solution.

7. 0.5925 g of potassium permanganate is dissolved in 250 cm^3 of its solution. Calculate the molarity of the solution.

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8. Calculate the molality of a solution containing 0.365 g of hydrochloric acid disssolved in 100 g of water.

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1. Calculate the volume of hydrogen liberated at STP when 3 g of a metal is completely dissolved in dilute sulphuric acid. (Equivalent mass of the metal is 9)

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2. Calculate the percentage of hydrogen in the hydride of an element. (Equivalent mass of the elements is 12.)

3. The mass of a metal, when heated with excess mass of oxygen, increases by 50%. Find the equivalent mass of the metal.

4. 0.13 g of aluminium displaces 0.47 g of copper from copper sulphate solution. 0.13 g of hydrogen is displaced by 1.17 g of

aluminium. Calculate the equivalent mass of copper from this data.

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5. 0.398 g a metallic oxide, when heated with a current of hydrogen, gives 0.09 g of water. Calculate the equivalent mass of the metal.

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6. The chloride of a metal contains 52.85% of metal. Calculate its equivalent mass.

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7. Calculate the mass of the metal of equivalent mass 9 required to get 8.9 g of its chloride?

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8. 9.525 g of copper displces 32.4 g of silver from a solution of silver nitrate. Find the equivalent mass of copper. (Equivalent mass of silver is 108.)

▶ View Text Solution

9. 2.16 g of a metal oxide, on heating, gives 112 cm^3 of oxygen at STP. Calculate the equivalent mass of the metal.

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10. 1.201 g of Zn gives 1.497 g of zinc oxide on treatment with nitric acid and subsequent ignition. In a second experiment, 0.527 g of Zn displaces 0.513 g of copper from a solution of copper sulphate. Calculate the equivalent mass of copper and zinc.

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11. 0.64 g of silver is converted into its chloride. Mass of chloride obtained is 0.85 g.

Find the equivalent mass of silver. (Equivalent mass of chlorine is 35.45.)

12. Equivalent mass of an element is

A. always fixed

B. always a whole number

C. atomic mass/valency

D. atomic mass $\times$ valency

Answer: C

13. The mass of 22.4 dm^3 at STP for any gas gives its

    A. equivalent mass

    B. atomic mass

    C. vapour density

    D. gram molecular mass

Answer: D

14. An oxide of a bivalent metal contains 40%, by mass, of oxygen. The atomic mass of the metal is

A. 12

B. 24

C. 60

D. 40

Answer: B

15. 1 g of hydrogen combines with 80 g of bromine, and 1 g of calcium combines with 4 g of bromine. The equivalent mass of calcium is

A. 4

B. 40

C. 20

D. 80

Answer: C

16. 3.15 g of metal oxide is reduced to 1.05 g of the metal. The equivalent mass of the metal is

A. 6

B. 8

C. 4

D. 2

Answer: C

17. The equivalent mass of Sn in $SnCl_2$ is

(atomic mass of Sn = 119)

    A. 119

    B. 59.5

    C. 29.75

    D. none of these

Answer: B

18. The equivalent mass of Al in Al_2O_3 is

(atomic mass of Al = 27)

   A. 27

   B. 13.5

   C. 9

   D. 52

Answer: C

19. When 6 g of magnesium reacts with excess mass of acid, the amount of hydrogen liberated will be

A. 0.5 g

B. 1.0 g

C. 2 g

D. 4 g

Answer: A

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20. How many molecules are present in 1 equivalent of hydrogen?

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21. What is the equivalent volume of oxygen at N.T.P?

22. The equivalent weight of a metal is 12. What is equivalent weight of its oxide?

23. 0.2 g of oxygen and 3.17 g of a halogen combine sepaartely with the same amount of a metal. What is the equivalent weight of the Halogen?

24. If W_1 and W_2 are the equivalent weight of two reactants in any reation, having their equivalent weights E_1 and E_2 respectively. Which of the following option is correct?

A. $W_1 E_1 = W_2 E_2$

B. $W_1 E_2 = W_2 E_1$

C. $W_1 W_2 = E_1 E_2$

D. All

Answer:

25. If 0.5 equivalent of H_2SO_4 undergoes complete dissociation. What will be the number of equivalents of H^+ and SO_4^{2-}?

26. Equivalent weight of sulphur in SCl_2 is 16, whart is the equivalent weight of S in S_2Cl_2?

27. The equivalent weight of a metal is double that of oxygen. How many times is the weight of its oxide greater than the weight of the metal?

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28. Fe forms two chlorides, $FeCl_2$ and $FeCl_3$. Does Fe have the same value of equivalent weight in its compounds?

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29. 1.80 g of a metal oxide required 833 ml of hydrogen at N.T.P. to be reduced to its metal. Find the equivalent weight of the oxide and the metal.

30. 5 g of Zn displaced 4.86 g of Cu from a copper sulphate solution. If Zn has an

equivalent weight of 32.5, find the equivalent weight of Cu.

▶ View Text Solution

31. 2 g of a metal when dissolved in nitric acid converted to its nitrate. The nitrate was then precipitated to 2.66 g of the metal chloride. Find the equivalent weight of the metal.

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32. 9.44 g of a metal oxide is formed by the combination of 5 g of the metal. Calculate equivalent weight of the metal.

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33. The equivalent weight of chlorine is 35.5 and the equivalent weight of copper chloride is 99. Find the formula of copper chloride if the atomic weight of Cu is 63.5.

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34. One litre of oxygen at N.T.P. weight 1.46 g. How many litres of oxygen are needed for the combination of 21 g of Mg whose equivalent weight $\frac{1}{2}$ mole.

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Mandatory Exercise Exercise Set Ii

1. Calculate the mass of the following sunstances required to prepare 250 mL of

their decinormal solutions:

Hydrochloric acid

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2. Calculate the mass of the following sunstances required to prepare 250 mL of their decinormal solutions:

Mohr's salt

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3. Calculate the normality and molarity of the following:

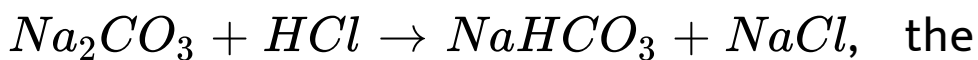0.4 g of sodium hydroxide in 2 L of the solution

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4. Calculate the normality and molarity of the following:

0.632 g of potassium permanganate in 0.5 L of the solution

5. As per the equation, $Na_2CO_3 + HCl \rightarrow NaHCO_3 + NaCl$, the equivalent mass of sodium carbonate is

A. 106

B. 10.6

C. 53

D. 5.3

Answer: A

6. Define n-factor for:

acid

7. Define n-factor for:

base

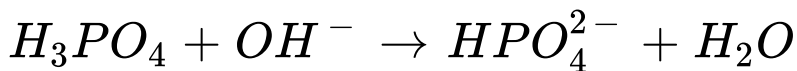**8.** Define n-factor for:

oxidising agent

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9. Find the equivalent weight of H_3PO_4 in following rection

$$H_3PO_4 + OH^- \rightarrow HPO_4^{2-} + H_2O$$

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10. Which of the following have n-factor equal to one

  A. H_3PO_2

  B. KOH

  C. HCl

  D. All
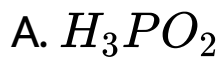
Answer: D

▶ View Text Solution

11. n-factor of H_3BO_3 is

A. 1

B. 2

C. 3

D. None

Answer: A

▶ **View Text Solution**

12. n-factor of $NaHCO_3$ as a base is

A. 0

B. 1

C. 2

D. None

Answer: B

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13. One gram of acid $C_6H_{10}O_4$ requires 0.768 g

of KCH for complete neutralisation. How many

neutral sable hydrogen atoms are in this molecule?

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14. The salt Na_3PO_4 is formed when othophosphoric acid is reacted with an alkali. Find the equivalent weight of orthophosphoric acid.

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15. The two acids H_2SO_4 and H_3PO_4 are neutralised separately by the same amount of an alkali when sulphate and dehydrogen orthophosphate are formed respectively. Find the ratio of the masses of H_2SO_4 and H_3PO_4.

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16. Find the number of equivalent of H^+ present in 1 mole H_2SO_4.

17. Why n-factor of H_3PO_4 is equal to one?

Mandatory Exercise Exercise Set Iii

1. Calculate the mass of the following substances required to prepare 250 mL of their decinormal solutions:

Potassium permanganate

2. Calculate the mass of the following substances required to prepare 250 mL of their decinormal solutions:

Sodium hydroxide

3. Calculate the normality and molarity of the following:

3.15 g of oxalic acid crystals in 500 mL of the solution

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4. Calculate the normality and molarity of the following:

1.225 g of potassium dichromate in 250 mL of the solution

▶ View Text Solution

5. Calculate the equivalent mass of the following:

Sulphuric acid, if in 250 mL of 0.1 N solution 1.225 g of sulphuric acid is present.

6. Calculate the equivalent mass of the following:

Sodium carbonate, if in 500 mL of 0.1 N

solution, 2.65 g of sodium carbonate is present.

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7. Calculate the malality of the following:

0.5 g sodium hydroxide dessolved in 500 g of water

▶ **View Text Solution**

8. Calculate the malality of the following:

18 g of glucose dissloved in 250 g or water

▶ View Text Solution

9. Number of equivalents of sodium hydroxide

in 1 L of 0.1 N sodium hydroxide solution is

A. 0.1

B. 10

C. 100

D. 0.2

Answer: A

▶ **View Text Solution**

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10. Which of the following has the highest normality?

A. 1 M H_2SO_4

B. 1 M HNO_3

C. 1 M H_3PO_4

D. both (A) and (B)

Answer: C

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11. A molal solution is one that contains 1 mole of a solute in

    A. 1000 g of the solvent

    B. 1 L of the solvent

    C. 1 L of the solution

D. 22.4 L of the solution

Answer: A

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12. 1 mole of each of the following acids is dissolved in 1 L solution. The acid that does not give a solution of strength 1 N is

A. HCl

B. HNO_3

C. H_2SO_4

D. none of these

Answer: C

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13. Molarity of a solution containing 1 g of

NaOH in 250 mL of its solution is

A. 0.1

B. 1

C. 0.01

D. 0.001

Answer: A

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14. Which of the following is independent of temperature?

A. Molarity

B. molality

C. Normality

D. All

Answer: B

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15. Which of the following is independent of molar mass of solvent?

A. Molarity

B. molality

C. Normality

D. All

Answer: D

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16. Normality of HCl solution is 0.1 N. Find the weight of HCl in 1 L solution.

A. 365 g

B. 36.5 g

C. 3.65 g

D. 0.365 g

Answer: C

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17. Normality of 0.1 M H_3PO_4 solution is

A. 0.1

B. 0.2

C. 0.3

D. None

Answer: C

▶ View Text Solution

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18. Calculate molarity of 1.8% (w/w) solution of glucose.

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19. Dissolving 120 g or urea (mol. Wt 60) in 1000 g of water gave a solution of density 1.15 g/ml. The molarity of solution is

A. 1.78 M

B. 2.0 M

C. 2.05 M

D. 2.22 M

Answer: C

20. The molarity of a urea solution in which 0.01 g of urea (NH_2CONH_2) is added to 0.3 dm^3 od water at STP is

A. 0.555 M

B. 5.5×10^{-4} M

C. 33.3 M

D. 3.33×10^{-2} M

Answer: B

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21. How many grams of sulphuric acid is to be dissolved to prepare 200 ml acqueous solution having concentration of $[H^+]$ ions 1 M at $25^\circ C$.

A. 4.9 g

B. 19.6 g

C. 9.8 g

D. 0.98 g

Answer: C

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22. What si the molarity of 0.2 N Na_2CO_3 solution?

A. 0.1 M

B. 0 M

C. 0.4 M

D. 0.2 M

Answer: A

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23. Calculate the mnormality of 250 ml aqueous solution of H_2SO_4 having $[H^+]$ = 1 M.

A. 0.25 N

B. 0.50 N

C. 1 N

D. 2 N

Answer: C

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24. What si the total number of moles of H_2SO_4 needed to prepare 5.0 L of a 2.0 M solution of H_2SO_4?

A. 2.5

B. 5

C. 10

D. 20

Answer: C

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25. $10\ cm^3$ of 0.1 N monobasic acid requires 15 cm^3 of sodium hydrogen solution whose normality is

A. 1.5 N

B. 0.15 N

C. 0.066 N

D. 0.66 N

Answer: C

26. What is the molarity of pure water?

27. The volume of water to be added to 100 cm^3 of 0.5 N H_2SO_4 to get decinormal concentration is.

    A. 400 cm^3

    B. 450 cm^3

C. $500 \ cm^3$

D. $100 \ cm^3$

Answer: A

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28. The molarity of the solution obtained by dissolving 2.5 g of NaCl in 100 ml of water is

A. 0.00428

B. 428

C. 0.428

D. 0.0428

Answer: C

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29. How many grams of dibasic acid (mol. Wt 200) should be present in 100 ml of the aqueous solution to give 0.1 N?

A. 10 g
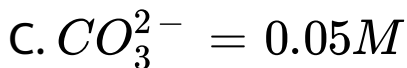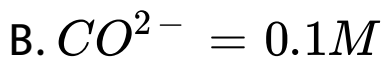
B. 20 g

C. 2 g

D. 1 g

Answer: D

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30. Which of the following is not true for 0.1 M

Na_2CO_3.

A. $Na^{\oplus} = 0.2M$

B. $CO^{2-} = 0.1M$

C. $CO_3^{2-} = 0.05M$

D. All

Answer: C

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31. 480 ml of 1.5 M and 520 ml of 1.2 M solution of same substance mixed together, molarity of final solution will be

A. 2.7 M

B. 1.35 M

C. 1.5 M

D. 1.2 M

Answer: B

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32. Molarity of 0.2 N H_2BO_3 is

A. 0.2 M

B. 0.6 M

C. 0.06 M

D. 0.1 M

Answer: A

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33. One molar solution means 1 mole of solute present in

A. 1000 g of solution

B. 1 L of solvent

C. 1 L of solution

D. 1000 g of solution

Answer: C

▶ **View Text Solution**

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34. The volume of water to be added to 100 ml of $\dfrac{N}{2}HCl$ to prepare 500 cm^3 of $\dfrac{N}{10}$ solution is

A. $450 \ cm^3$

B. $100 \ cm^3$

C. $45 \ cm^3$

D. $400 \ cm^3$

Answer: D

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35. 6.022×10^{20} molecules of glucose are present in 100 ml of the solution. The concentration of glucose solution is

A. 0.001 M

B. 0.01 M

C. 0.02 M

D. 0.1 M

Answer: B

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36. The normality of mixture obtained by mixing 100 ml of 0.2 M H_2SO_4 + 100 ml 0.2 M NaOH is

A. 0.2

B. 0.01

C. 0.1

D. 0.3

Answer: C

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37. The unit of molarity is

A. mole L^{-1}

B. mole kg^{-1}

C. mole$^{-1}L^{-1}$

D. mole L

Answer: B

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38. 1 L of NaOH solution contains 8 g if NaOH. The approximate concentration of the solution is

A. 0.1 N

B. $\dfrac{N}{10}$

C. 0.1 M

D. 0.2 M

Answer: D

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39. A solution of oxalix acid $(COOH)_2 \cdot 2H_2O$ is prepared by dissolving 0.63 g of the acid in

$250 \ cm^3$ of the solution. Calculate (a) molarity and (b) normality of the solution.

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40. Commercially available concentrated hydrochloric acid conatins 38% HCl by mass. What is the molarity of this solution if the density is 1.19 g cm^{-3}?

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41. Commercially available concentrated hydrochloric acid conatins 38% HCl by mass. What volume of concentrated HCl is required to make 1.00 L of 0.10 M HCl?

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42. 20 cm^3 of 1 N HCl and 30 cm^3 of 0.5 N HCl are mmixed together. What will be the normality of the final solution?

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43. Concentrated aqueous H_2SO_4 is 98% H_2SO_4 by mass and has density of 1.84 g cm^{-3}. What volume of this acid is required to make 5.0 L of 0.500 M H_2SO_4 solution?

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44. Match the following:

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1. 5 L of 0.1 M solution of sodium carbonate contains

    A. 53 g of Na_2CO_3

    B. 106 g of Na_2CO_3

    C. 10.6 g of Na_2CO_3

    D. 5×0^2 millimoles of Na_2CO_3

Answer: A::D

2. 2.4 g of pure Mg (at amss 24) is dipped in 100 mL of 1 N HCl. What is true?

A. 1.12 L of hydrogen is produced at NTP

B. 0.01 mole of magnesium is left behind

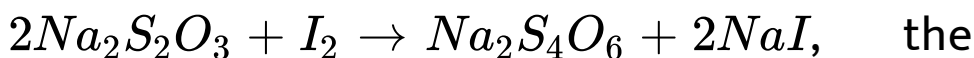C. 0.1 mole of Mg^{2+} ions is formed in solution

D. HCl is the limiting reagent

Answer: A::B::D

3. In te reaction

$$2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI,$$ the

equivalent mass of $Na_2S_2O_3$ (molecular mass

= M) is

A. M

B. $\dfrac{M}{2}$

C. $\dfrac{2M}{2}$

D. $\dfrac{2M}{4}$

Answer: A::C::D

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4. The mass of $Ag \times 10^3$ (molecular mass 170)

present in 100 mL of its 0.25 M solution is

A. 4.25 g

B. 42.5 g

C. 17 g

D. 1.7 g

Answer: A

5. The number of millimoles and milliequivalents present in 20 mL of 0.2 mole of $Ba(OH)_2$ is respectively

A. 4, 4

B. 2, 4

C. 4, 8

D. 8, 4

Answer: C

Challenging Exercise

1. Calculate the equivalent mass of sulphur dioxide when it reacts with hydrogen sulphide to form sulphur and water.

2. Equivalent mass of a trivalent metal is 16.5. Find the molecular mass of its chloride.

3. The molecular mass of a trivalent metal oxide is 160. Find the equivalent mass of the metal in its oxide.

4. The equivalent mass of titanium is 13. Find the percentage of oxygen in the oxide of titanium.

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5. Calculate the number of oxalic acid molecules in 100 mL of 0.02 N oxalic acid solution.

▶ **View Text Solution**

6. Calculate the molarity and molarity of a 20% solution (m/m) of hydrochloric acid with a density of 1.1 g/mL.

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1. 1.0 g of a monpbasic acid when completely acted upon Mg gave 1.301 g of anhydrous Mg salt. Equivalent weight of acid is

A. 35.54

B. 36.54

C. 17.77

D. 18.27

Answer: B

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2. The Mw of a oxide of an element is 44. the Ew of the element is 14. the atomic weight of the element is
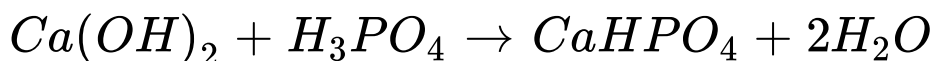
A. 14

B. 28

C. 42

D. 56

Answer: A

▶ **View Text Solution**

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3. The Ew of H_3PO_4 in the reaction is

$$Ca(OH)_2 + H_3PO_4 \rightarrow CaHPO_4 + 2H_2O$$

(Ca = 40, P = 31, O = 16)

A. 49

B. 98

C. 32.66

D. 147

Answer: A

▶ **View Text Solution**

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4. The molarity of H_2SO_4 is 18 M. Its density is

1.8 g mL^-. Hence, molality is:

A. 36

B. 200

C. 500

D. 18

Answer: C

▶ View Text Solution

5. What is the valency of an element of which the equivalent weight is 12 and the specific heat is 0.25?

A. 1

B. 2

C. 3

D. 4

Answer: B

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6. What weight of a metal of equivalent weight

12 will give 0.475 g of its chloride?

A. 0.12 g

B. 0.24 g

C. 0.36 g

D. 0.48 g

Answer: A

▶ **View Text Solution**

7. The molality of 1 L solution with x% H_2SO_4

is equal to 9. The weight of the solvent

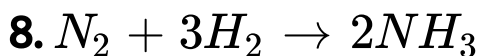present in the solution is 910 g. The value of x

is:

A. 90

B. 80.3

C. 40.13

D. 9

Answer: B

View Text Solution

8. $N_2 + 3H_2 \rightarrow 2NH_3$

Molecular weight of NH_3 and N_2 are x_1 and x_2, respctively. Their equivalent weights are y_1 and y_2, respectively. Then $(y_1 - y_2)$ is

A. $\left(\dfrac{2x_1 - x_2}{6} \right)$

B. $(x_1 - x_2)$

C. $(3x_1 - x_2)$

D. $(x_1 - 3x_2)$

Answer: A

9. 36.5% HCl has density equal to 1.20 g mL^-. The molarity (M) and molality (m), respectively, are

A. 15.7, 15.7

B. 12, 12

C. 15.7, 12

D. 12, 15.7

Answer: D

10. Mole fraction of a solute in an aqueous solution is 0.2. The molality of the solution will be

A. 13.88

B. 1.388

C. 0.138

D. 0.0138

Answer: A