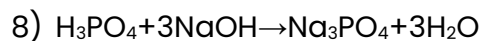


## **Model answer lesson 4 chapter 2**

<b>Question</b>	<b>Answer</b>	<b>Question</b>	<b>Answer</b>
<b>1</b>	<b>D</b>	<b>21</b>	<b>C(Steps)</b>
<b>2</b>	<b>D</b>	<b>22</b>	<b>C(Steps)</b>
<b>3</b>	<b>D</b>	<b>23</b>	<b>C(Steps)</b>
<b>4</b>	<b>A</b>	<b>24</b>	<b>A(Steps)</b>
<b>5</b>	<b>B</b>	<b>25</b>	<b>C(Steps)</b>
<b>6</b>	<b>B</b>	<b>26</b>	<b>D(Steps)</b>
<b>7</b>	<b>D</b>	<b>27</b>	<b>A(Steps)</b>
<b>8</b>	<b>A(Steps)</b>		
<b>9</b>	<b>D (Steps)</b>		
<b>10</b>	<b>A(Steps)</b>		
<b>11</b>	<b>C(Steps)</b>		
<b>12</b>	<b>B(Steps)</b>		
<b>13</b>	<b>A(Steps)</b>		
<b>14</b>	<b>B(Steps)</b>		
<b>15</b>	<b>C(Steps)</b>		
<b>16</b>	<b>B(Steps)</b>		
<b>17</b>	<b>A(Steps)</b>		
<b>18</b>	<b>A(Steps)</b>		
<b>19</b>	<b>B(Steps)</b>		
<b>20</b>	<b>B(Steps)</b>		

## Steps:

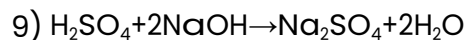


$$\frac{Ma \times Va}{na} = \frac{Mb \times Vb}{nb}$$

$$\frac{X \times 750 \times 10^{-3}}{1} = \frac{0.25 \times 125 \times 10^{-3}}{3}$$

$M_a = 0.014 \text{ M}$

Acid ( $\text{H}_3\text{PO}_4$ )	Base (NaOH)
$M_a = X$	$M_b = 0.25 \text{ M}$
$V_a = 750 \times 10^{-3} \text{ L}$	$V_b = 125 \times 10^{-3} \text{ L}$
$n_a = 1$	$n_b = 3$

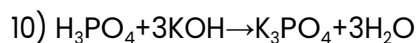


$$\frac{Ma \times Va}{na} = \frac{Mb \times Vb}{nb}$$

$$\frac{2 \times X}{1} = \frac{2 \times 20 \times 10^{-3}}{2}$$

$V_{\text{acid}} = 10 \times 10^{-3} \text{ L} = 10 \text{ ml}$

Acid ( $\text{H}_2\text{SO}_4$ )	Base (NaOH)
$M_a = 2 \text{ M}$	$M_b = 2 \text{ M}$
$V_a = X$	$V_b = 20 \times 10^{-3} \text{ L}$
$n_a = 1$	$n_b = 2$

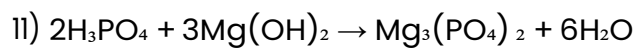


$$\frac{Ma \times Va}{na} : \frac{Mb \times Vb}{nb}$$

$$\frac{0.3 \times 50 \times 10^{-3}}{1} : \frac{0.1 \times 100 \times 10^{-3}}{3}$$

Acid ( $\text{H}_3\text{PO}_4$ )	Base (KOH)
$M_a = 0.3 \text{ M}$	$M_b = 0.1 \text{ M}$
$V_a = 50 \times 10^{-3} \text{ L}$	$V_b = 100 \times 10^{-3} \text{ L}$
$n_a = 1$	$n_b = 3$

Since, Acid > Base, Therefore, solution is acidic > yellow color

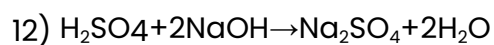


$$\frac{M_a \times V_a}{na} : \frac{M_b \times V_b}{nb}$$

$$\frac{0.6 \times 100 \times 10^{-3}}{2} : \frac{0.6 \times 100 \times 10^{-3}}{3}$$

Acid ( $\text{H}_3\text{PO}_4$ )	Base ( $\text{Mg}(\text{OH})_2$ )
$M_a = 0.6 \text{ M}$	$M_b = 0.6 \text{ M}$
$V_a = 100 \times 10^{-3} \text{ L}$	$V_b = 100 \times 10^{-3} \text{ L}$
$n_a = 2$	$n_b = 3$

Since, Acid > Base, Therefore, solution is acidic > red color

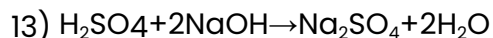


$$\frac{M_a \times V_a}{na} : \frac{M_b \times V_b}{nb}$$

$$\frac{0.2 \times 50 \times 10^{-3}}{1} : \frac{0.1 \times 100 \times 10^{-3}}{2}$$

Acid ( $\text{H}_2\text{SO}_4$ )	Base ( $\text{NaOH}$ )
$M_a = 0.2 \text{ M}$	$M_b = 0.1 \text{ M}$
$V_a = 50 \times 10^{-3} \text{ L}$	$V_b = 100 \times 10^{-3} \text{ L}$
$n_a = 1$	$n_b = 2$

Since, Acid > Base, Therefore, solution is acidic > red color

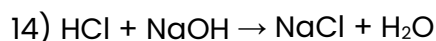


$$\frac{M_a \times V_a}{n_a} : \frac{M_b \times V_b}{n_b}$$

$$\frac{0.2 \times 10 \times 10^{-3}}{1} : \frac{0.1 \times 20 \times 10^{-3}}{2}$$

Acid ( $\text{H}_2\text{SO}_4$ )	Base ( $\text{NaOH}$ )
$M_a = 0.2 \text{ M}$	$M_b = 0.1 \text{ M}$
$V_a = 10 \times 10^{-3} \text{ L}$	$V_b = 20 \times 10^{-3} \text{ L}$
$n_a = 1$	$n_b = 2$

Since, Acid > Base, Therefore, solution is acidic > red color



By supposing : equal volume

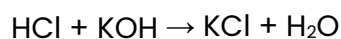
$$\frac{M_a \times V_a}{n_a} : \frac{M_b \times V_b}{n_b}$$

$$\frac{0.2 \times 1}{1} : \frac{0.25 \times 1}{1}$$

Acid ( $\text{HCl}$ )	Base ( $\text{NaOH}$ )
$M_a = 0.2 \text{ M}$	$M_b = 0.25 \text{ M}$
$V_a = 1 \text{ L}$	$V_b = 1 \text{ L}$
$n_a = 1$	$n_b = 1$

Since, Acid < Base, Therefore, solution is basic > blue color

15) Note : graduation of burette start from 0 & end with 15 ml

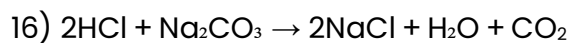


$$\frac{M_a \times V_a}{n_a} = \frac{M_b \times V_b}{n_b}$$

$$\frac{0.2 \times x}{1} = \frac{0.1 \times 10}{1}$$

Acid ( $\text{HCl}$ )	Base ( $\text{KOH}$ )
$M_a = 0.2 \text{ M}$	$M_b = 0.1 \text{ M}$
$V_a = x \text{ ml}$	$V_b = 10 \text{ ml}$
$n_a = 1$	$n_b = 1$

X = 5ml , as we start from 10 ml and we need 5 ml to reach end point so final volume reading is **15ml**

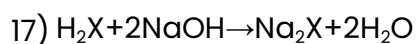


$$\frac{Ma \times Va}{na} = \frac{Mb \times Vb}{nb}$$

$$\frac{0.1 \times x}{2} = \frac{0.25 \times 25 \times 10^{-3}}{1}$$

$$V_{\text{acid}} = 0.125\text{L} = 125\text{ ml}$$

Acid (HCl)	Base (Na <sub>2</sub> CO <sub>3</sub> )
<b>M<sub>a</sub> = 0.1M</b>	<b>M<sub>b</sub> = 0.25M</b>
<b>V<sub>a</sub> = xL</b>	<b>V<sub>b</sub> = 25x10<sup>-3</sup> L</b>
<b>n<sub>a</sub> = 2</b>	<b>n<sub>b</sub> = 1</b>

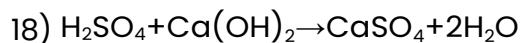


$$\frac{Ma \times Va}{na} = \frac{Mb \times Vb}{nb}$$

$$\frac{x \times 25 \times 10^{-3}}{1} = \frac{0.1 \times 20.2 \times 10^{-3}}{2}$$

$$M_{\text{acid}} = 0.0404\text{M}$$

Acid (H <sub>2</sub> X)	Base (NaOH)
<b>M<sub>a</sub> = x</b>	<b>M<sub>b</sub> = 0.1M</b>
<b>V<sub>a</sub> = 25x10<sup>-3</sup> L</b>	<b>V<sub>b</sub> = 20.2x10<sup>-3</sup> L</b>
<b>n<sub>a</sub> = 1</b>	<b>n<sub>b</sub> = 2</b>



from graph X is formed at  $V_a = 10 \times 10^{-3} \text{ L}$

$$\frac{Ma \times Va}{na} = \frac{Mb \times Vb}{nb}$$

$$\frac{0.1 \times 10 \times 10^{-3}}{1} = \frac{x \times 10 \times 10^{-3}}{1}$$

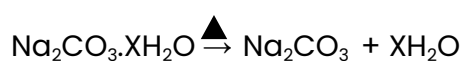
$$M_{\text{base}} = 0.1 \text{ molar}$$

Acid (H <sub>2</sub> SO <sub>4</sub> )	Base (Ca(OH) <sub>2</sub> )
<b>M<sub>a</sub> = 0.1 M</b>	<b>M<sub>b</sub> = X M</b>
<b>V<sub>a</sub> = 10 X 10<sup>-3</sup> L</b> <b>Graph</b>	<b>V<sub>b</sub> = 10 x 10<sup>-3</sup> L</b>
<b>n<sub>a</sub> = 1</b>	<b>n<sub>b</sub> = 1</b>

19)

- Mass of washing soda crystals before heating = 5 g
- Mass after strong heating of soda crystals = 1.853 g
- So, water crystallization of washing soda =  $5 - 1.853 = 3.147$  g
- % water crystallization =  $\frac{\text{water crystallization of washing soda}}{\text{total mass}} \times 100 = \frac{3.147}{5} \times 100 = 62.9\%$

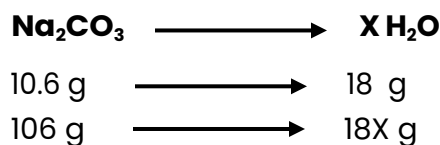
20)



Mass of  $\text{Na}_2\text{CO}_3 = 10.6$  g

Molar mass of  $\text{Na}_2\text{CO}_3 = (2 \times 23) + 12 + (3 \times 16) = 106$  g

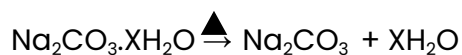
Molar mass of water =  $(2 \times 1) + 16 = 18$  g



$$18X = \frac{106 \times 18}{10.6} = 180, \quad x = \frac{180}{18} = 10$$

Chemical formula of salt =  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

21)



Mass of hydrated salt = 2.86 g

Mass of anhydrous salt = 1.06 g

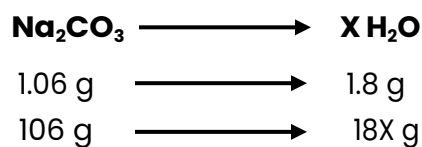
Mass of water = Mass hydrated – Mass anhydrate =  $2.86 - 1.06 = 1.8$  g

mass percentage of water =  $\frac{\text{mass of water}}{\text{mass of sample}} \times 100$

mass percentage of water =  $\frac{1.8}{2.86} \times 100 = 62.93\%$

Molar mass of  $\text{Na}_2\text{CO}_3 = (2 \times 23) + 12 + (3 \times 16) = 106 \text{ g}$

Molar mass of water =  $(2 \times 1) + 16 = 18 \text{ g}$



$$18X = \frac{106 \times 1.8}{1.06} = 180, \quad x = \frac{180}{18} = 10$$

Chemical formula of salt =  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

22)



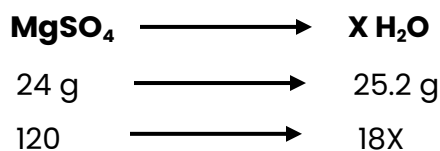
Mass of hydrated salt = 49.2 g

Mass of anhydrous salt = 24 g

Mass of water = Mass hydrated – Mass anhydrate =  $49.2 - 24 = 25.2 \text{ g}$

Molar mass of  $\text{MgSO}_4 = 120 \text{ g}$

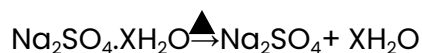
Molar mass of water =  $(2 \times 1) + 16 = 18 \text{ g}$



$$18X = \frac{120 \times 25.2}{24} = 126, \quad x = \frac{126}{18} = 7$$

Chemical formula of salt =  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$

23)



Mass of hydrated salt = 2.68 g

Mass of water = 1.26 g

Mass of anhydrous salt = Mass hydrated – Mass water = 2.68 – 1.26 = 1.42g

Molar mass of  $\text{Na}_2\text{SO}_4 = (2 \times 23) + 32 + (4 \times 16) = 142\text{g}$

Molar mass of water =  $(2 \times 1) + 16 = 18\text{g}$



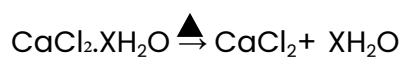
$$1.42\text{g} \longrightarrow 1.26\text{g}$$

$$142\text{g} \longrightarrow 18\text{X}$$

$$18\text{X} = \frac{142 \times 1.26}{1.42} = 126, \quad \text{X} = \frac{126}{18} = 7$$

Chemical formula of salt =  $\text{Na}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}$

24)



Molar mass of  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O} = 40 + (2 \times 35.5) + (2 \times 18) = 147\text{ g}$

Molar mass of water =  $(2 \times 1) + 16 = 18\text{ g}$

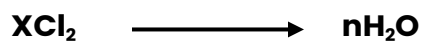
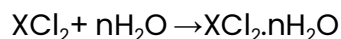


$$147\text{ g} \longrightarrow 18\text{x} = 2 \times (18) = 36\text{ g}$$

$$1.47\text{ g} \longrightarrow \text{X g}$$

$$\text{X} = \frac{1.47 \times 36}{147} = 0.36\text{ g}$$

25)



$$0.1\text{mole} \longrightarrow 10.8\text{g}$$

$$1\text{mole} \longrightarrow 18\text{X}$$

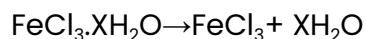
Molar mass of water =  $(2 \times 1) + 16 = 18\text{ g}$



$$18X = \frac{1 \times 10.8}{0.1} = 108, \quad x = \frac{108}{18} = 6$$

Chemical formula of salt =  $\text{XCl}_2 \cdot 6\text{H}_2\text{O}$

26)



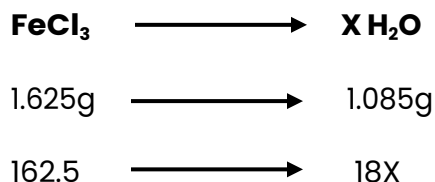
Mass of hydrated salt = 2.71 g

Mass of anhydrous salt = 1.625 g

Mass of water = Mass hydrated – Mass anhydrate = 2.71 – 1.625 = 1.085 g

Molar mass of  $\text{FeCl}_3 = 56 + (3 \times 35.5) = 162.5 \text{ g}$

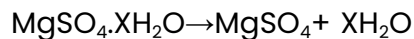
Molar mass of water =  $(2 \times 1) + 16 = 18 \text{ g}$



$$18X = \frac{162.5 \times 1.085}{1.625} = 108.5, \quad x = \frac{108.5}{18} = 6$$

Chemical formula of salt =  $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$

27)

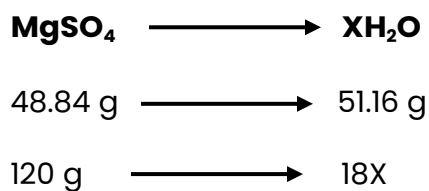


percentage of water crystallization ( $\text{XH}_2\text{O}$ ) = 51.16%

Percentage of salt ( $\text{MgSO}_4$ ) = 100% – 51.16% = 48.84%

Molar mass of  $\text{MgSO}_4 = 24 + 32 + (4 \times 16) = 120 \text{ g}$

Molar mass of  $\text{H}_2\text{O} = (2 \times 1) + 16 = 18 \text{ g}$



$$18x = \frac{120 \times 51.16}{48.84} = 125.7, \quad x = \frac{125.7}{18} \approx 7$$

Formula of salt:  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$