

Model answer lesson 4 chapter 2

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

Steps:

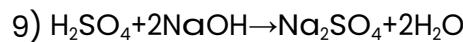


$$\frac{M_a \times V_a}{n_a} = \frac{M_b \times V_b}{n_b}$$

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

$$M_a = 0.014 \text{ M}$$

Acid (H_3PO_4)	Base (NaOH)
$M_a = X$	$M_b = 0.25 \text{ M}$
$V_a = 750 \times 10^{-3} \text{ L}$	$V_b = 125 \times 10^{-3} \text{ L}$
$n_a = 1$	$n_b = 3$

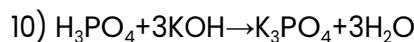


$$\frac{M_a \times V_a}{n_a} = \frac{M_b \times V_b}{n_b}$$

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

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

Acid (H_2SO_4)	Base (NaOH)
$M_a = 2 \text{ M}$	$M_b = 2 \text{ M}$
$V_a = X$	$V_b = 20 \times 10^{-3} \text{ L}$
$n_a = 1$	$n_b = 2$

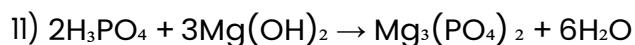


$$\frac{M_a \times V_a}{n_a} : \frac{M_b \times V_b}{n_b}$$

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

Acid (H_3PO_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



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

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

Acid (H_3PO_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

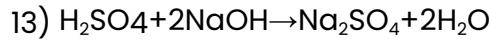


$$\frac{Ma \times Va}{na} : \frac{Mb \times Vb}{nb}$$

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

Acid (H_2SO_4)	Base (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 (H_2SO_4)	Base (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

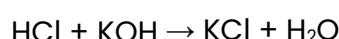
$$\frac{M_a \times V_a}{n_a} : \frac{M_b \times V_b}{n_b}$$

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

Acid (HCl)	Base (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

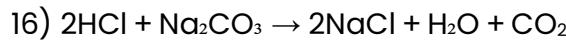


$$\frac{M_a \times V_a}{n_a} = \frac{M_b \times V_b}{n_b}$$

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

Acid (HCl)	Base (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**

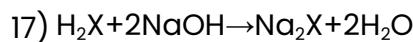


$$\frac{Ma \times Va}{na} = \frac{Mb \times Vb}{nb}$$

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

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

Acid (HCl)	Base (Na ₂ CO ₃)
M _a = 0.1M	M _b =0.25M
V _a =xL	V _b =25x10 ⁻³ L
n _a =2	n _b =1

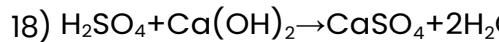


$$\frac{Ma \times Va}{na} = \frac{Mb \times Vb}{nb}$$

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

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

Acid (H ₂ X)	Base (NaOH)
M _a = x	M _b =0.1M
V _a =25x10 ⁻³ L	V _b =20.2x10 ⁻³ L
n _a =1	n _b =2



from graph X is formed at V_a = 10 x10⁻³ 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 ₂ SO ₄)	Base (Ca(OH) ₂)
M _a = 0.1M	M _b = X M
V _a = 10 X 10 ⁻³ L Graph	V _b =10 x10 ⁻³ L
n _a =1	n _b =1

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= $\frac{\text{water crystallization of washing soda}}{\text{total mass}} \times 100 = \frac{3.147}{5} \times 100 = 62.9\%$

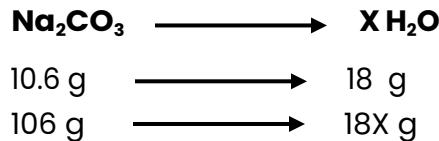
20)



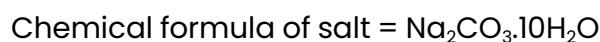
$$\text{Mass of Na}_2\text{CO}_3 = 10.6 \text{ g}$$

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

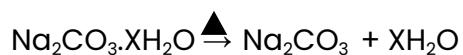
$$\text{Molar mass of water} = (2 \times 1) + 16 = 18 \text{ g}$$



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



21)



$$\text{Mass of hydrated salt} = 2.86 \text{ g}$$

$$\text{Mass of anhydrous salt} = 1.06 \text{ g}$$

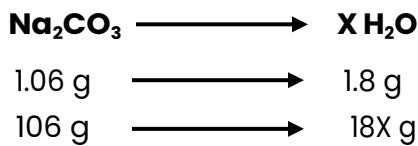
$$\text{Mass of water} = \text{Mass hydrated} - \text{Mass anhydrate} = 2.86 - 1.06 = 1.8 \text{ g}$$

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

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

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

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



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

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

22)



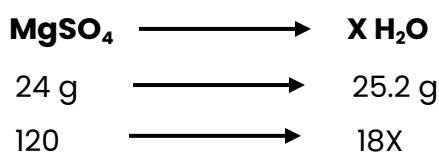
Mass of hydrated salt = 49.2 g

Mass of anhydrous salt = 24 g

Mass of water = Mass hydrated – Mass anhydrate = $49.2 - 24 = 25.2$ g

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

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



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

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

23)



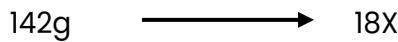
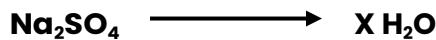
Mass of hydrated salt = 2.68 g

Mass of water = 1.26 g

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

Molar mass of Na_2SO_4 = $(2 \times 23) + 32 + (4 \times 16) = 142\text{g}$

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



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

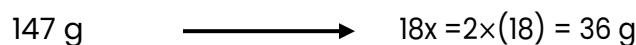
Chemical formula of salt = $\text{Na}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}$

24)



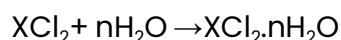
Molar mass of $\text{CaCl}_2 \cdot 2\text{H}_2\text{O} = 40 + (2 \times 35.5) + (2 \times 18) = 147\text{ g}$

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



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

25)

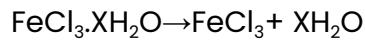


Molar mass of water = $(2 \times 1) + 16 = 18\text{ g}$

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

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

26)



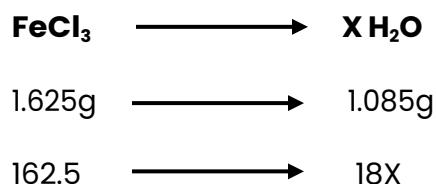
Mass of hydrated salt = 2.71 g

Mass of anhydrous salt = 1.625 g

Mass of water = Mass hydrated – Mass anhydrite = $2.71 - 1.625 = 1.085$ g

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

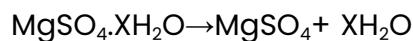
Molar mass of water = $(2 \times 1) + 16 = 18$ g



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

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

27)

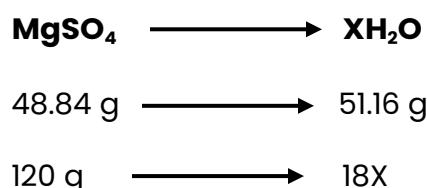


percentage of water crystallization (XH_2O) = 51.16%

Percentage of salt (MgSO_4) = $100\% - 51.16\% = 48.84\%$

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

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



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

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