

## **Model answer Lesson 5 Chapter 3**

<b>Question</b>	<b>Answer</b>	<b>Question</b>	<b>Answer</b>
<b>1</b>	<b>C</b>	<b>38</b>	<b>D</b>
<b>2</b>	<b>D</b>	<b>39</b>	<b>D</b>
<b>3</b>	<b>B</b>	<b>40</b>	<b>A</b>
<b>4</b>	<b>A</b>	<b>41</b>	<b>D</b>
<b>5</b>	<b>D</b>	<b>42</b>	<b>C</b>
<b>6</b>	<b>C</b>	<b>43</b>	<b>A</b>
<b>7</b>	<b>D</b>	<b>44</b>	<b>B</b>
<b>8</b>	<b>D</b>	<b>45</b>	<b>C</b>
<b>9</b>	<b>C</b>	<b>46</b>	<b>A</b>
<b>10</b>	<b>D</b>	<b>47</b>	<b>C</b>
<b>11</b>	<b>B</b>	<b>48</b>	<b>C</b>
<b>12</b>	<b>D</b>	<b>49</b>	<b>D</b>
<b>13</b>	<b>B</b>	<b>50</b>	<b>B</b>
<b>14</b>	<b>C</b>	<b>51</b>	<b>6.63 (steps↓)</b>
<b>15</b>	<b>C</b>	<b>52</b>	<b>C (steps↓)</b>
<b>16</b>	<b>D</b>	<b>53</b>	<b>C (steps↓)</b>
<b>17</b>	<b>A</b>	<b>54</b>	<b>B (steps↓)</b>
<b>18</b>	<b>A</b>	<b>55</b>	<b>B (steps↓)</b>
<b>19</b>	<b>A</b>	<b>56</b>	<b>C (steps↓)</b>
<b>20</b>	<b>B</b>	<b>57</b>	<b>A (steps↓)</b>
<b>21</b>	<b>D</b>	<b>58</b>	<b>B (steps↓)</b>
<b>22</b>	<b>B</b>	<b>59</b>	<b>A (steps↓)</b>
<b>23</b>	<b>B</b>	<b>60</b>	<b>A (steps↓)</b>
<b>24</b>	<b>D</b>	<b>61</b>	<b>D (steps↓)</b>
<b>25</b>	<b>C</b>	<b>62</b>	<b>C (steps↓)</b>
<b>26</b>	<b>D</b>	<b>63</b>	<b>D (steps↓)</b>
<b>27</b>	<b>A</b>	<b>64</b>	<b>C (steps↓)</b>
<b>28</b>	<b>C</b>	<b>65</b>	<b>B (steps↓)</b>
<b>29</b>	<b>A</b>	<b>66</b>	<b>D (steps↓)</b>
<b>30</b>	<b>C</b>	<b>67</b>	<b>B (steps↓)</b>

<b>31</b>	<b>A</b>	<b>68</b>	<b>B (steps↓)</b>
<b>32</b>	<b>C</b>	<b>69</b>	<b>B (steps↓)</b>
<b>33</b>	<b>C</b>	<b>70</b>	<b>D (steps↓)</b>
<b>34</b>	<b>C</b>	<b>71</b>	<b>C (steps↓)</b>
<b>35</b>	<b>B</b>	<b>72</b>	<b>B (steps↓)</b>
<b>36</b>	<b>A</b>	<b>73</b>	<b>A (steps↓)</b>
<b>37</b>	<b>D</b>		

### Steps:

**51)**  $K_w = [H^+] \times [OH^-]$

$$5.476 \times 10^{-14} = [H^+] \times [OH^-]$$

Where each is of concentration  $x$ ,

$$5.476 \times 10^{-14} = x^2$$

$$x = 0.234 \times 10^{-6}$$

$$pH = -\log [H^+]$$

$$pH = -\log (0.234 \times 10^{-6}) = 6.63$$

**52)**  $pH = -\log [H^+]$

$$pH = -\log (0.01) = 2$$

**53)**  $[H^+] = \sqrt{K_a \times C_a}$

$$[H^+] = \sqrt{1.2 \times 10^{-8} \times 0.2} = 48.98 \times 10^{-6}$$

$$pH = -\log [H^+]$$

$$pH = -\log (48.98 \times 10^{-6}) = 4.3$$

**54)**  $pOH = -\log [OH^-]$

$$\text{pOH} = -\log(0.01) = 2$$

$$\text{pH} + \text{pOH} = 14$$

$$\text{pH} = 14 - 2 = 12$$

$$\mathbf{55)} [\text{OH}^-] = \sqrt{K_b \times C_b}$$

$$[\text{OH}^-] = \sqrt{1.8 \times 10^{-5} \times 0.01} = 4.24 \times 10^{-4}$$

$$\mathbf{56)} \text{pOH} = -\log [\text{OH}^-]$$

$$\text{pOH} = -\log(10^{-4}) = 4$$

$$\text{pH} + \text{pOH} = 14$$

$$\text{pH} = 14 - 4 = 10$$

$$\mathbf{57)} [\text{H}^+] = [\text{H}_3\text{O}^+]$$

$$\text{pH} = -\log [\text{H}^+]$$

$$\text{pH} = -\log(10^{-4}) = 4, \text{ therefore, acidic}$$

$$\mathbf{58)} [\text{H}^+] = \text{shift log} - \text{pH}$$

$$[\text{H}^+] = \text{shift log} - 2.63 = 0.00234$$

$$[\text{H}^+] = \sqrt{K_a \times C_a}, \text{ when 2 sides are powered by 2}$$

$$[\text{H}^+]^2 = K_a \times C_a$$

$$K_a = \frac{[\text{H}^+]^2}{C_a} = \frac{0.00234^2}{0.01} = 5.49 \times 10^{-4}$$

$$\mathbf{59)} \text{pH} + \text{pOH} = 14$$

$$\text{pH} = 14 - 2.5 = 11.5$$

$$[\text{H}^+] = \text{shift log} - \text{pH}$$

$$[\text{H}^+] = \text{shift log} - 11.5 = 3.16 \times 10^{-12}$$

**60)**  $\text{pH} = -\log [\text{H}^+]$

$$\text{pH} = -\log (10^{-13}) = 13$$

$$\text{pH} + \text{pOH} = 14$$

$$\text{pOH} = 14 - 13 = 1$$

**61)**  $\text{pH} + \text{pOH} = 14$

$$\text{pOH} = 14 - 12 = 2$$

$$[\text{OH}^-] = \text{shift log} - \text{pOH}$$

$$[\text{OH}^-] = \text{shift log} - 2 = 0.01$$

$$\text{Concentration} = \frac{\text{no. of moles}}{\text{volume of solution (L)}}$$

$$0.01 = \frac{x}{1}$$

$$x = 0.01 \text{ moles}$$

$$1 \text{ mole of NaOH} \rightarrow \text{molar mass} = (23+16+1) = 40\text{g}$$

$$0.01 \text{ moles} \rightarrow x$$

$$x = 0.01 \times 40 = 0.4\text{g}$$

**62)**  $[\text{H}^+] = \text{shift log} - \text{pH}$

$$[\text{H}^+] = \text{shift log} - 3 = 0.001$$

$$[\text{H}^+] = \sqrt{K_a \times C_a}, \text{ when 2 sides are powered by 2}$$

$$[H^+]^2 = K_a \times C_a$$

$$K_a = \frac{[H^+]^2}{C_a} = \frac{0.001^2}{0.1} = 10^{-5}$$

**63)** 1 mole of NaOH  $\rightarrow$  molar mass = (23+16+1) = 40g

x moles  $\rightarrow$  0.4g

$$x = 0.4/40 = 0.01 \text{ moles}$$

$$\text{Concentration} = \frac{\text{no. of moles}}{\text{volume of solution (L)}}$$

$$\text{Concentration} = \frac{0.01}{0.2} = 0.05M$$

$$pH = -\log [H^+]$$

$$pH = -\log (0.05) = 1.3$$

**64)**  $[H^+] = \text{shift log} - pH$

$$[H^+] = \text{shift log} - 13 = 10^{-13}$$

$$\text{Concentration} = \frac{\text{no. of moles}}{\text{volume of solution (L)}}$$

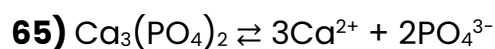
$$10^{-13} = \frac{x}{1 \times 10^{-3}}$$

$$x = 10^{-16} \text{ moles}$$

$$1 \text{ mole} \rightarrow 6.02 \times 10^{23} \text{ ions}$$

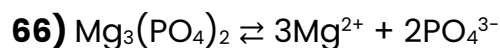
$$10^{-16} \text{ moles} \rightarrow x$$

$$x = 10^{-16} \times 6.02 \times 10^{23} = 6.02 \times 10^7 \text{ ions}$$



$$K_{sp} = (Ca^{2+})^3 \times (PO_4^{3-})^2$$

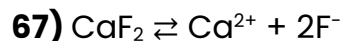
$$K_{sp} = (2 \times 10^{-8})^3 \times (1 \times 10^{-3})^2 = 8 \times 10^{-30}$$



$$K_{sp} = (\text{Mg}^{2+})^3 \times (\text{PO}_4^{3-})^2$$

$$K_{sp} = (3x)^3 \times (2x)^2 = 27x^3 \times 4x^2 = 108x^5$$

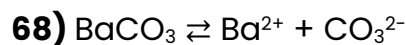
$$K_{sp} = 108 \times (6.26 \times 10^{-6})^5 = 1.038 \times 10^{-24} = 1.04 \times 10^{-24}$$



$$K_{sp} = (\text{Ca}^{2+}) \times (\text{F}^-)^2$$

$$K_{sp} = (x) \times (2x)^2 = x \times 4x^2 = 4x^3 = 3.5 \times 10^{-11}$$

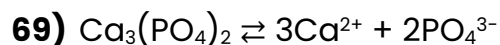
$$x = \sqrt[3]{\frac{3.5 \times 10^{-11}}{4}} = 2.06 \times 10^{-4}$$



$$K_{sp} = (\text{Ba}^{2+}) \times (\text{CO}_3^{2-})$$

$$K_{sp} = (x) \times (x) = x^2$$

$$K_{sp} = (4 \times 10^{-5})^2 = 1.6 \times 10^{-9}$$



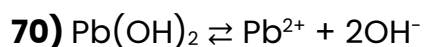
$$K_{sp} = (\text{Ca}^{2+})^3 \times (\text{PO}_4^{3-})^2$$

$$(\text{PO}_4^{3-}) = 2x = 3.3 \times 10^{-7}$$

$$x = 165 \times 10^{-9}$$

$$(\text{Ca}^{2+}) = 3x = 3 \times 165 \times 10^{-9} = 495 \times 10^{-9}$$

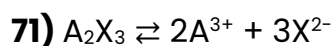
$$K_{sp} = (495 \times 10^{-9})^3 \times (3.3 \times 10^{-7})^2 = 1.32 \times 10^{-32}$$



$$K_{sp} = (Pb^{2+}) \times (OH^-)^2$$

$$K_{sp} = (x) \times (2x)^2 = x \times 4x^2 = 4x^3 = 2.5 \times 10^{-6}$$

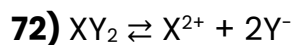
$$x = \sqrt[3]{\frac{2.5 \times 10^{-6}}{4}} = 8.54 \times 10^{-3}$$



$$K_{sp} = (A^{3+})^2 \times (X^{2-})^3$$

$$K_{sp} = (2x)^2 \times (3x)^3 = 4x^2 \times 27x^3 = 108x^5$$

$$x = \sqrt[5]{\frac{1.08 \times 10^{-23}}{108}} = 1 \times 10^{-5}$$



$$K_{sp} = (X^{2+}) \times (Y^-)^2$$

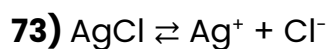
$$K_{sp} = (x) \times (2x)^2 = x \times 4x^2 = 4x^3$$

$$x = \sqrt[3]{\frac{1.6 \times 10^{-10}}{4}} = 3.419 \times 10^{-4}$$

$$\text{Concentration} = \frac{\text{no. of moles}}{\text{volume of solution (L)}}$$

$$3.419 \times 10^{-4} = \frac{x}{2}$$

$$x = 6.838 \times 10^{-4} \text{ moles} = 6.84 \times 10^{-4} \text{ moles}$$



$$K_{sp} = (Ag^+) \times (Cl^-)$$

$$K_{sp} = (x) \times (x) = x^2 = 2.56 \times 10^{-6}$$

$$x = \sqrt{2.56 \times 10^{-6}} = 0.0016M$$

$$\text{Concentration} = \frac{\text{no. of moles}}{\text{volume of solution (L)}}$$

$$0.0016 = \frac{x}{0.1}$$

$$x = 160 \times 10^{-6} \text{ moles}$$

$$1 \text{ mole of AgCl} \rightarrow \text{molar mass} = (108 + 35.5) = 143.5 \text{g}$$

$$160 \times 10^{-6} \text{ moles} \rightarrow \text{yg}$$

$$x = 143.5 \times 160 \times 10^{-6} = 0.0229 \text{g} = 0.023 \text{g}$$

