**Unit 2: TT 4 Concentration**

**SECTION A: Multiple-choice questions (1 mark each)**

**Question 1**

*Answer:* D

*Explanation:*

Saturated solutions can be cooled carefully. If no crystallisation occurs, the solution will be supersaturated.

**Question 2**

*Answer:* C

*Explanation:*

V2 = c1V1/c2 = 0.05 x 2/0.4 = 250 mL

As there is already 50 mL of water, 200 more mL need to be added.

**Question 3**

*Answer:* C

*Explanation:*

74/100 x 500 = 370 mL

**Question 4**

*Answer:* A

*Explanation:*

n = c x V = 0.1 x 0.5 = 0.05 mol mass = 0.05 x 58.5 = 2.93 g

**Question 5**

*Answer:* A

*Explanation:*

500 mL of 2.0 M NaOH = 0.5 x 2 = 1.0 mol

40 g, 1 mol

50 mL of 0.1 M NaOH 0.05 x 0.1 = 0.005 mol

1.0 L of 0.05 M NaOH = 1 x 0,05 = 0.05 mol

**Question 6**

*Answer:* B

*Explanation:*

n(KOH) = 0.12 x 0.02 = 0.0024 mol n(oxalic) = 0.0012 mol

c(oxalic) = 0.0012/0.015 = 0.16 M

**Question 7**

*Answer:* C

*Explanation:*

A weak acid is weak in water but not in an acid/base reaction.

**Question 8**

*Answer:* D

*Explanation:*

Standard definition of equivalence point.

**Question 9**

*Answer:* C

*Explanation:*

To precipitate the calcium ions an anion needs to be added that will form an insoluble ionic compound with calcium. Calcium carbonate is insoluble.

**Question 10**

*Answer:* B

*Explanation:*

ppm = mg per kg which is 8 mg per kg

**SECTION B: Short-answer questions**

**Question 1** (7 marks)

**a**. **i**. 15 g per 100 mL = 150 g L-1 1 mark

**ii**. %(m/v) = 15/100 \* 100 = 15%(m/v) 1 mark

**iii**. n= 15/40 = 0.375 mol c=n/V = 0.375/0.1 = 3.75 M 1 mark

**b**. c2 = c1 x V1 /V2 = 0.005 x 3.75/0.25 = 0.075 M 2 marks

**c**. n(NaOH) = 3 x 0.6 = 1.8 mol m = n x M = 1.8 x 40 = 72 g 2 marks

**Question 2** (10 marks)

**a. i**. Solubility generally increases with temperature but the degree of change varies significantly.

2 marks

**ii**. Solubility is mass that can be dissolved in 100 g of water. This can be tested by setting up a series of test-tubes and dissolving varied masses of a substance in hot water. Allow the test-tube to cool and record the temperature at which the first sign of crystals appear. The temperature will be higher as the mass of substance increases. 3 marks

**iii**. Add hot water to a test-tube. Keep adding potassium nitrate until no further will dissolve. Cool slowly – the solution will be supersaturated as long as crystals do not form. 2 marks

**b. i**. At 60 0C 40 g of salt will dissolve in 100 g of water. If 40 g is used, the mass that will dissolve is 40 x 40/100 = 16 g 1mark

**ii**. 10 g of potassium chlorate in 50 g is equivalent to 20 g in 100 g of water. From the graph this is around 50 0C. 2 marks

**Question 3** (11 marks)

**a. i**. Pb2+(aq) + Na2SO(aq) 🡪 PbSO4(s) + 2Na+(aq) 2 marks

**ii**. The addition of sodium sulfate will cause a precipitate of lead sulfate to form. The sample can be filtered to remove the precipitate. Other agents could be added to precipitate other unwanted impurities. 3 marks

**b**. **i**. The graph shows that the solubility of gases decreases as the temperature goes up. The degree to which this happens varies. 2 marks

**ii**. Gases respond in the opposite way to ionic substances. The solubility of gases decreases with temperature while the solubility of ionic substances increases. 2 marks

**iii**. Most marine creatures rely on dissolved oxygen in water to breathe. As temperature increases, the oxygen level will decrease. If the temperature becomes high enough this could be a serious deficit. 2 marks

**Question 4** (12 marks)

**a**. **i**. n=0.25 x 0.1 = 0.025 mol mass = n x M = 0.025 x 106 = 2.65 g.

Add this mass of sodium carbonate to a 250 mL volumetric flask. Add some deionized water. Stir. Make up to the mark with water. 3 marks

**ii**. Perhaps 8 or 9 – definitely above 7 1 mark

**iii**. phenolphthalein 1 mark

**iv**. NaOH is too reactive with air and water to be used as a primary standard. When trying to measure an accurate mass of sodium hydroxide, you are probably also including some amount of water or sodium carbonate. 2 marks

**b**. **i**. burette: vinegar 2 marks

conical flasks: deionized water

**ii**. The first titre should be ignored therefore the mean titre is 13.0 mL

n(NaOH) = c x V = 0.15 x 0.02 = 0.003 mol = n(ethanoic)

c= n/V = 0.003/0.013 = 0.231 M 3 marks