Full Name: February 22, 2023

0.1 Classify the following reaction as acid-base or precipitation:

(a) $H_2SO_{4(aq)} + Ba(OH)_{2(aq)} \longrightarrow BaSO_{4(aq)} + 2\,H_2O_{(l)}$

(b) $Na_2CO_{3(aq)} + BaCl_{2(aq)} \longrightarrow BaCO_{3(s)} + 2\,NaCl_{(aq)}$

(c) $4\,Fe + 3\,O_2 \longrightarrow 2\,Fe_2O_3$

0.2 Classify the following reaction as acid-base or precipitation:

(a) $NaCl_{(aq)} + AgNO_{3\ (aq)} \longrightarrow NaNO_{3(aq)} + AgCl_{(s)}\downarrow$

(b) $H_2SO_{4(aq)} + 2\,NaOH_{(aq)} \longrightarrow 2\,H_2O_{(l)} + Na_2SO_{4(aq)}$

(c) $2\,Na_3PO_{4(aq)} + 3\,CaCl_{2(aq)} \longrightarrow 6\,NaCl_{(aq)} + Ca_3(PO_4)_{2(s)}\downarrow$

0.3 Break down the following compounds into ions: (a) H_2SO_4 (b) HNO_3 (c) $KMnO_4$

0.4 Break down the following compounds into ions: (a) $Ca(OH)_2$ (b) K_2CrO_4 (c) $Ca(NO_3)_2$

0.5 Indicate whether solutions of the following chemicals will have ions (I), ions and molecules (I+M), or just molecules (M):

Chemical	I	I+M	M
H_2O			
NO_2			
CO_2			

0.6 Indicate whether solutions of the following chemicals will have ions (I), ions and molecules (I+M), or just molecules (M):

Chemical	I	I+M	M
NaCl			
HCl			
$CaCl_2$			

0.7 Indicate the soluble/insoluble character of the following compounds:

Chemical	Soluble	Insoluble
$NaCH_3COO$		
$NaHCO_3$		
Ag_2SO_4		
$NaCrO_4$		
CaS		

0.8 Indicate the soluble/insoluble character of the following compounds:

Chemical	Soluble	Insoluble
$AgNO_3$		
$AgBr$		
$CaCO_3$		
Na_2CO_3		

0.9 Obtain the net ionic equation for the following reaction:

$$H_2SO_{4(aq)} + 2\,NaOH_{(aq)} \longrightarrow 2\,H_2O_{(l)} + Na_2SO_{4(aq)}$$

0.10 Obtain the net ionic equation for the following reaction:

$$NaCl_{(aq)} + AgNO_{3\ (aq)} \longrightarrow NaNO_{3(aq)} + AgCl_{(s)}\downarrow$$

0.11 Obtain the net ionic equation for the following reaction:

$$NaHSO_{4(aq)} + NH_{3(aq)} \longrightarrow NaNH_4SO_{4(aq)}$$

0.12 Obtain the net ionic equation for the following reaction:

$$2\,Na_3PO_{4(aq)} + 3\,CaCl_{2(aq)} \longrightarrow 6\,NaCl_{(aq)} + Ca_3(PO_4)_{2(s)}\downarrow$$

0.13 Balance the following redox reactions in acidic medium:

$$MnO_4{}^-{}_{(aq)} + SO_3{}^{-2}{}_{(aq)} \longrightarrow MnO_{2(s)} + SO_4{}^{-2}{}_{(aq)}$$

0.14 Balance the following redox reactions in acidic medium:

$$I^-_{(aq)} + MnO_4{}^-{}_{(aq)} \longrightarrow I_{2(s)} + Mn^{2+}_{(aq)}$$

0.15 Balance the following redox reactions in acidic medium:

(a) $Zn_{(s)} + {NO_3}^{-}{}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + NO_{2(g)}$

(b) $O_{2(g)} + Fe^{2+}_{(aq)} \longrightarrow Fe^{3+}_{(aq)}$

0.16

0.17 Balance the following redox reaction in basic medium:

(a) $Sn_{(s)} + {NO_3}^{-}{}_{(aq)} + Cl^{-}_{(aq)} \longrightarrow {SnCl_6}^{2-}{}_{(aq)} + NO_{2(g)}$

0.18 Balance the following redox reactions in basic medium:

(a) $Sn^{2+}_{(aq)} + {Cr_2O_7}^{2-}{}_{(aq)} \longrightarrow Cr^{3+}_{(aq)} + Sn^{4+}_{(aq)}$

(b) $FeS_{(s)} + {NO_3}^{-}{}_{(aq)} \longrightarrow NO_{(g)} + Fe^{3+}_{(aq)} + {SO_4}^{2-}{}_{(aq)}$

0.19 Balance the following redox reactions:

(a) $Cu^{+}_{(aq)} + Fe_{(s)} \longrightarrow Fe^{3+}_{(aq)} + Cu_{(s)}$

(b) $Ag_{(s)} + Zn^{2+}_{(aq)} \longrightarrow Ag^{+}_{(aq)} + Zn_{(s)}$

0.20 Balance the following redox reactions:

(a) $Fe_{(s)} + O_{2(g)} \longrightarrow Fe^{3+}_{(aq)} + O^{2-}_{(aq)}$

(b) $Cu_{(s)} + Ag^{+}_{(aq)} \longrightarrow Ag_{(s)} + Cu^{2+}_{(aq)}$

0.21 What is the concentration of a solution prepared when 100mL a 4% HCl solution is diluted to a final volume of 500mL.

0.22 What is the final volume when 50mL of a 2M NaCl solution is diluted to a 1M.

0.23 Describe how to prepare 100mL of a 0.1M H_2SO_4 solution, starting with a 2M stock H_2SO_4 solution.

0.24 Describe how to prepare 50mL of a 0.5M H_2SO_4 solution, starting with a 1M stock H_2SO_4 solution.

0.25 Classify the following molecules as polar or nonpolar: (a) $H_2O_{(l)}$ (b) $C_5H_{12(l)}$ (c) $CH_3COOH_{(l)}$ (d) $CH_3OH_{(l)}$

0.26 Classify the following molecules as polar or nonpolar: (a) $C_6H_{14(l)}$ (b) $CH_3CH_2CH_2OH_{(l)}$ (c) $C_5H_{10(l)}$ (d) $C_6H_5CH_{3(l)}$ (e) $CH_3CH_2OH_{(l)}$ (f) $C_6H_5NH_{2(l)}$

0.27 A solution is prepared by mixing 15g of KCl in 50g of water. Calculate the mass percent of solute.

0.28 Sodium hydroxide NaOH, a very strong base, is a chemical used in drain cleaners. A drain cleaning solution is prepared by mixing 25g of NaOH in 250g of water. Calculate the mass percent of solute.

0.29 Vinegar is not a pure chemical, it is indeed a (m/m) 5% acetic acid solution. How many grams of acetic acid are there in 2g of vinegar.

0.30 Alcohol-hydroxide is a mixture of a base with an organic alcohol, employed to clean glass. An alcohol-hydroxide mixture is prepared by mixing 60g of NaOH with 500g of ethanol. Calculate: (a) the mass percent of solvent. (b) the mass percent of solute.

0.31 Order the following solution from more to less concentrated: (a) Solution A (4.3×10^{-5}M) (b) Solution B (6.1×10^{-3}M) (c) Solution C (6.4×10^{-4}M)

0.32 Order the following solution from more to less concentrated: (a) A vanillin solution (1.3×10^{-1}M) (b) An adrenaline solution (1.1×10^{3}M) (c) Vinegar, an acetic acid solution (1.2×10^{0}M)

0.33 Which chemicals from the following list will mix with $C_5H_{12(l)}$: (a) $H_2O_{(l)}$ (b) $C_6H_{14(l)}$ (c) $CH_3COOH_{(l)}$

0.34 Which chemicals from the following list will mix with $H_2O_{(l)}$: (a) $NH_{3(l)}$ (b) $C_5H_{12(l)}$ (c) $C_6H_{14(l)}$

0.35 How many mL of a 0.001M $Ca(OH)_2$ (MW=74g/mol) solution can be prepared from 5 mg of $Ca(OH)_2$.

0.36 How many grams of solute are there in 100mL of a 0.01M HNO_3 (MW=63g/mol) solution.

0.37 How many mL of a 3M KCl solution contains 0.06 moles of KCl.

0.38 An HCl solution is prepared by mixing 4 moles of HCl with water until reaching a volume of 250mL. Calculate the molarity of the solution.

0.39 How many mL of a 1M NaCl (MW=58g/mol) solution contains 4 grams of NaCl.

0.40 How many mL of a 4M NaCl (MW=58g/mol) solution contains 5 grams of NaCl.

0.41 A solution is made by mixing 2 mL of a solute and 100mL of solvent. Calculate the Percent Volume/Volume.

0.42 Vanilla extract is a solution vanillin in ethanol. A vanilla solution is made by mixing 15 mL of pure vanillin and 50mL of ethanol. Calculate the Percent Volume/Volume.

0.43 A solution is prepared by mixing 5 g of $Au_{(s)}$ and 2 g of $Cu_{(s)}$. Indicate the true statement: (a) Au is the solute (b) Cu is the solute (c) Both elements do not mix (d) The mixture is not a solution

0.44 A solution is prepared by mixing 4 g of $C_6H_{6(l)}$ and 10 g of $CCl_{4(l)}$. Indicate the true statement: (a) C_6H_6 is the solute (b) CCl_4 is the solute (c) Both chemicals do not mix (d) The mixture is not a solution

Answersv. 60 **0.1** (a) Acid-base (b) Precipitation (c) redox **0.2** (a) Precipitation (b) Acid-base (c) Precipitation **0.3** (a) $2\,H^+ + SO_4{}^{2-}$ (b) $H^+ + NO_3{}^-$ (c) $K^+ + MNO_4{}^-$ **0.4** (a) $(Ca^{2+} + 2\,OH^-$ (b) $2\,K^+ + CrO_4{}^{2-}$ (c) $Ca^+ + 2\,NO_3{}^-$ **0.5** H_2O (M+I);NO_2 (M) ;CO_2 (M) **0.6** NaCl(I); HCl (I); $CaCl_2$ (I) **0.7** $NaCH_3COO$(Soluble); $NaHCO_3$(Soluble); Ag_2SO_4(Insoluble); $NaCrO_4$(Soluble); CaS(Insoluble); **0.8** $AgNO_3$(Soluble); AgBr (Insoluble); $CaCO_3$(Soluble);Na_2CO_3(Soluble) **0.9**

0.10 $Ag^+{}_{(aq)} + Cl^-{}_{(aq)} \longrightarrow AgCl_{(s)}\downarrow$ **0.11** $HSO_4{}^-{}_{(aq)} + NH_{3(aq)} \longrightarrow NH_4{}^+{}_{(aq)} + SO_4{}^{2-}{}_{(aq)}$ **0.12** $3\,Ca^{2+}{}_{(aq)} + 2\,PO_4{}^{3-}{}_{(aq)} \longrightarrow Ca_3(PO_4)_{2(s)}\downarrow$ **0.13** $2\,MnO_4{}^-{}_{(aq)} + 2\,H^+ + 3\,SO_3{}^{-2}{}_{(aq)} \longrightarrow H_2O_{(l)} + 2\,MnO_{2(s)} + 3\,SO_4{}^{-2}{}_{(aq)}$ **0.14** $10\,I^-_{(aq)} + 2\,MnO_4{}^-{}_{(aq)}{}^+ 16\,H^+_{(aq)} \longrightarrow 5\,I_{2(s)} + 2\,Mn^{2+}_{(aq)} + 8\,H_2O_{(l)}$ **0.15** No solution listed **0.16** **0.17** No solution listed **0.18** No solution listed **0.19** (a) $3\,Cu^+_{(aq)} + Fe_{(s)} \longrightarrow Fe^{3+}_{(aq)} + 3\,Cu_{(s)}$ (b) $2\,Ag_{(s)} + Zn^{2+}_{(aq)} \longrightarrow 2\,Ag^+_{(aq)} + Zn_{(s)}$ **0.20** (a) $4\,Fe_{(s)} + 3\,O_{2(g)} \longrightarrow 4\,Fe^{3+}_{(aq)} + 6\,O^{2-}_{(aq)}$ (b) $Cu_{(s)} + 2\,Ag^+_{(aq)} \longrightarrow 2\,Ag_{(s)} + Cu^{2+}_{(aq)}$ **0.21** 0.8 % **0.22** 100 mL **0.23** 5mL **0.24** 25mL **0.25** (a) $H_2O_{(l)}$ (polar) (b) $C_5H_{12(l)}$ (nonpolar) (c) $CH_3COOH_{(l)}$ (polar) (d) $CH_3OH_{(l)}$ (polar) **0.26** (a) $C_6H_{14(l)}$ (nonpolar) (b) $CH_3CH_2CH_2OH_{(l)}$ (polar) (c) $C_5H_{10(l)}$ (nonpolar) (d) $C_6H_5CH_{3(l)}$ (nonpolar) (e) $CH_3CH_2OH_{(l)}$ (polar) (f) $C_6H_5NH_{2(l)}$ (polar) **0.27** 23% **0.28** 9% **0.29** 0.1 g **0.30** (a) 89% (b) 11% **0.31** A≥C≥B **0.32** adrenaline≥vinegar≥vanillin **0.33** $C_6H_{14(l)}$ (nonpolar) **0.34** $NH_{3(l)}$ (polar) **0.35** 67.56mL **0.36** 0.062g **0.37** 20mL **0.38** 16M **0.39** 69mL **0.40** 21mL **0.41** 1.9% **0.42** 23% **0.43** Cu is the solute **0.44** C_6H_6 is the solute