## Acids & Bases Revision Answer

1. Pungent, react with metals to form H2, sour, caustic, react with bases to neutralize, react with indicators

 2. Mineral acids (inorganic acid): an acid derived from one or more inorganic compounds. E.g. sulfuric acid (H2SO4), hydrochloric acid (HCl), nitric acid (HNO3). They are usually strong acids that completely ionise (dissociate) in water

Organic acids: an acid derived from organic compounds (organic = contains carbon). E.g. carboxylic acids, alcohols. Generally they are weak acids that do not ionise (dissociate) completely in water.

3. H2SO4 \_Sulphuric acid; Nitric Acid \_HNO3

4. Acetic acid is weak organic acid, so it only partially ionises, giving few H+ ions to react whereas nitric acid is a strong inorganic acid and it fully ionises to produce more H+ ions under the same concentration.

5. React with acids to neutralize, bitter taste, slippery feel, caustic, react with indicators

6. In the same volume, concentrated H­2SO4 has more H+ ions to react than dilute H2SO4.

7. Dissociate (ionise): molecules separate into smaller particles (atoms, or ions), in a reversible manner.

8. A base is any substance that accepts protons (H+) that were donated by acids.

Alkali: a special type of base which is soluble in water e.g. metal oxides. The alkali gives hydroxide (OH-) ions in the aqueous solution.

9. A mole is the quantity of a substance that has 6.022 x 1023 particles in it.

A mole is the amount of substance that contains as many particles (atoms, ions or molecules) as there are atoms in exactly 12 g of the Carbon-12 isotope ($)$.

10. Molar mass (M): mass of 1 mole of an element, molecule or compound (units = grams per mole (g.mol-1))

11. a) The molar mass of (NH4)2CO3 = $\left(14+4\right)×2+12+3×16=96g/mol$

b) The molar mass of C6H12O6 is 180 g/mol.

12 pH is $-log⁡[H^{+}]$ where [H+] is the concentration of H+ in the solution. pH stands for the potential to produce H+ ions. If pH is 10, the concentration of H+ in the solution is 10-10 mol/L.

13. c

14. a

15. Neutralisation

16.

a. ammonium hydroxide reacts with nitric acid

NH4OH + HNO3 → NH4NO3 + H2O

b. zinc metal reacts with hydrochloric acid

Zn + 2HCl → ZnCl2 +H2

c. phosphoric acid reacts with lithium oxide

2H3PO4 + 3Li2O → 2Li3PO4 + 3H2O

d.sulphuric acid reacts with potassium bicarbonate

H­2SO4 + 2KHCO3 → K2SO4 + 2H2O + 2CO2

17. monoprotic- an acid that can donate only 1 proton to a base, diprotic- an acid that has two ionisable hydrogen atoms in each molecule. Polyprotic – can donate more than 1 proton

18.

a)  H3PO4(aq)    +   NO2-(aq)  →  HNO2(aq)  +  H2PO4-(aq)

acid Base conjugate acid conjugate base

b)  CN- (aq)      +   HCO3-(aq) →    HCN(aq)    +  CO32-(aq)

 base acid conjugate acid conjugate base

c)   HCN(aq)     +  SO32-(aq) →   HSO3-(aq) +   CN-(aq)

acid base conjugate acid conjugate base

d) H2O(l)    +  HF(aq)  →  F-(aq) +   H3O+(aq)

 base acid conjugate base conjugate acid

19. Water can act as either a weak acid or a weak base as it can either accept a proton to form H3O+ or lose a proton to form OH-.

20. A solution contains 4.5 x 10-3 mol/L hydrochloric acid. Determine the following:

a) [H3O+] = 4.5 x 10 -3 mol/L

b) [OH] = 1 x 10 -14 / (4.5 x 10 -3 )= 2.22 x 10 -12 mol/L

c) pH = -log(4.5 x 10 -3) = 2.35

21. A solution contains 0.025 mol/L sulfuric acid. Determine the following:

a)     [H3O+]= 2 \* 0.025 = 0.05 mol/L

b)    [OH-] = (1 x 10 -14 )/ 0.05 = 2 x 10 -13 mol/L

c)     pH = -log (0 .05) =1.30

 22. A solution contains 0.067 mol/L of sodium hydroxide. Determine the following

a)     [H3O+]= 1 x 10-14/ 0.067 =  1.49 x 10 -13 mol/L

b)   [OH-]= 0.067 mol/L

c)     pOH = 1.17

d)    pH= 14 – 1.17 = 12.8

23.

                 Na2CO3  +  Ca(NO3)2  →  2NaNO3   +  CaCO3

                 235 mL                                                             ?g

                 0.444 mol/L

    (0.235L) x (0.444mol/L)= 0.104 moles of Na2CO3 .

1/1 x 0.104 moles

m = n x M

 = 0.104 moles x 100 g/mol= 10.4 g

 = 10.4 g     of  CaCO3

24. A 20 mL sample of sulphuric acid is placed into a conical flask and this is titrated with sodium hydroxide.

|  |  |  |  |
| --- | --- | --- | --- |
| Titration | Initial reading (mL) | Final Reading (mL) | Titre volume (mL) |
| Rough | 5.6 | 37.1 | 31.5 |
| 2 | 4.5 | 38.0 | 33.5 |
| 3 | 10.2 | 41.8 | 31.6 |
| 4 | 8.8 | 40.3 | 31.5 |

1. What is the standard solution in this prac and what does the end point suggest?

The standard solution is sodium hydroxide. The end point indicated by the faintest colour change suggests the titration is finished, as the unknown solution (acid) is neutralised by the standard solution Base).

1. Which value would you discard and why?

The second value should be discarded, as it is much higher than the rest and the difference between concordant titres should be within 0.1 mL.

1. What is the average titre?

The average titre is 31.53 mL.

1. What equipment do you deliver the sodium hydroxide with? How would you rinse it?

Sodium hydroxide is delivered with a burette. The burette is filled with distilled water. Then the burette is rotated to make sure all the internal surfaces are covered. Run some water through the tap. The burette is again filled with a small amount of sodium hydroxide. The burette is rotated to make sure all the surfaces are covered. Run some sodium hydroxide through the tap and the rest through the top of burette.

1. What equipment do you deliver the acid with? How would you rinse it?

The equipment used is a 20 mL volumetric pipette. Rinse the pipette with distilled water by sucking up some distilled water from a clean beaker. Rotate the pipette horizontally so that water touches all the surfaces. Drain the water. Suck up a small amount of the sulphuric acid from another clean beaker into the pipette. Then rotate the burette and drain it.

f. If the concentration of the base is 0.5 mol/L, calculate the concentration of the acid.

$0.03153 L×0.5\frac{mol}{L}÷2÷0.015L=0.53 mol/L$ put into more individual steps

First step – write balanced equation:

H2SO4 + 2NaOH → Na2SO4 + 2H2O

Second step - find the moles of known

$$n=c×v=0.5\frac{mol}{L}×0.03153 L=0.01577 mol of NaOH$$

Third step – unknown/known of mole ratio coefficients multiplied by known moles

The number of moles of H2SO4 = $1÷2×0.01577=0.007883 mol of Sulphuric acid$

Fourth step – calculate concentration of unknown

$$c=\frac{n}{v}=0.007883÷0.02=0.3941 mol/L$$

1. If you took the titre reading below eye level, you would read a value larger than the actual value. That means the difference between the initial and final reading would be larger than what is supposed to be and this would suggest that the titre would be greater than what is should be. In the calculation, you would think more sodium hydroxide was used, which would result in more H2SO4 present in the flask than the actual amount. As a result, the concentration of the acid would be calculated to be higher than the actual value.

25. A strong acid is able to donate all the hydrogens to the reaction while a weak acid can only partially donate hydrogens in the solution.

26. Yes, it is possible. A weak acid can be present in a concentrated solution (with much less solvent)

27. A standard solution whose concentration is known is used to determine the concentration of an unknown solution in a titration.