(Concentrations of solutions)

Q1. a). (2018)

(titre):
chooses titrations 3, 4, 5

average titre = 22.13 (cm^3)

(calculation):
(moles NaOH =

$$\frac{22.13}{1000} \times 0.105 = 0.002324)$$

(moles H_2SO_4 =
½ × 0.002324 =) 0.001162

(concentration =

$$\frac{0.001162}{25} \times 1000)$$

= 0.0465 (mol/dm^3)

Q1. b). (2018)
pipette measures a fixed volume (accurately)

(but) burette measures variable volume

Q2. (2018)

$(\text{moles} =) \frac{30}{1000} \times 0.105$

or 0.00315 (mol)

or
(mass per dm^3 =) 0.105×40
or 4.2 (g)

$(\text{mass} = \frac{30}{1000} \times 0.105 \times 40)$
$= 0.126$ (g)

Q3. a). (2019)

burette

Q3. b). (2019)

27.6 (cm^3)

Q4. (2019)

allow converse using acid added to alkali

Key steps

- measure the volume of acid
- add indicator to the acid
- add sodium hydroxide solution
- until the colour changes
- record volume of sodium hydroxide solution added
- repeat procedure with the other acid

Use of results

- compare the two volumes of sodium hydroxide solution to find which sample **P** or **Q** is more concentrated

Other points

- pipette to measure volume of acid
- use a few drops of indicator
- swirl
- use a white tile
- rough titration to find approximate end point
- add dropwise near the endpoint
- read volume from bottom of meniscus
- repeat and take a mean

Q5. (2019)

(moles H_2SO_4 = 0.500 × $\frac{15.5}{1000}$)
= 0.00775

(moles KOH = 2 x moles H_2SO_4
= 2 x 0.00775)
= 0.0155

(conc KOH = moles KOH x $\frac{1000}{25.0}$)
= 0.0155 x $\frac{1000}{25.0}$

= 0.62 (mol/dm^3)

(M_r KOH =) 56

(conc = M_r x conc in mol/dm^3 =
56 x 0.62)
= 34.7 (g/dm^3)

Q6. (2020)

add the citric acid (to the flask) until there is a (permanent) colour change

measure / record the volume (of citric acid) added

any **one** from:
- swirl
- use a white tile
- add the citric acid dropwise (near the end-point)
- repeat **and** calculate a mean

Q7. (2020)

- can add (the citric acid) in small increments

- can measure variable volumes
- more accurate than a measuring cylinder

Q8. (2020)

(moles citric acid = $\frac{13.3}{1000} \times 0.0500$)
= 0.000665

(moles NaOH = 3 × 0.000665)
= 0.001995

(conc = $\frac{1000}{25} \times 0.001995$)
= 0.0798 (mol/dm^3)

Q9. (2021)

- swirl (the solution)
- white tile (under the flask)
- add (ethanedioic) acid dropwise (near the endpoint)
- repeat **and** calculate mean

Q10. (2021)

(concentration = 90 × 0.0480 =)
4.32 (g/dm^3)

(mass = 4.32 × $\frac{250}{1000}$) = 1.08 (g)

Q11. (2021)

(moles $H_2C_2O_4 = \frac{15.0}{1000} \times 0.0480$)
= 0.00072 (mol)

(moles NaOH =
moles $H_2C_2O_4 \times 2 =$)
0.00144 (mol)

(concentration= $\frac{0.00144}{25.0} \times 1000$)
= 0.0576 (mol/dm^3)

Q12. a). (2022)

the mean of titration numbers 2 to 5 values is calculated

(because) 23.90 (cm^3) is an anomalous result

Q12. b). (2022)

(moles $Ba(OH)_2$ =

$\frac{23.50}{1000} \times 0.100$) = 0.00235

(moles HCl = 0.00235 × 2 =)
0.00470

(concentration =)
$0.00470 \times \frac{1000}{25.0}$

= 0.188 (mol/dm^3)

Q12. c). (2022)

there are no ions that are free to move

(because) barium sulfate is solid / insoluble

(and) hydrogen ions have reacted with hydroxide ions to produce water

Q12. d). (2022)

the mixture (now) contains barium ions and hydroxide ions that are free to move

Q13. (2023)

the mass of acid dissolved is doubled and the volume of the solution is halved

Q14. (2023)

methyl orange

from yellow to red / orange / pink

OR

phenolphthalein (1)

from pink to colourless (1)

OR

litmus (1)

from blue to red (1)

Q15. (2023)

(moles $Na_2CO_3 = \frac{25.0}{1000} \times 0.124$)

$= 0.0031(0)$

(moles $HNO_3 = 2 \times 0.0031(0)$)
$= 0.0062(0)$

(concentration =) $\frac{0.0062(0)}{23.6} \times 1000$

$= 0.262711864$

$= 0.263$ (mol/dm^3)

Q16. (2024)

use a (volumetric) pipette to add the alkali

any **two** from:

- into a conical flask
- add an indicator (to the alkali)
- take the initial burette reading
- use a white tile (under a conical flask)

Q17. (2024)

(volume of HCl = $\frac{0.0045}{0.15}$)
= 0.030 (dm^3)

(conversion 0.030 dm^3 =)
30 (cm^3)