ANSWER KEY

Chapter 8 Test Answer Key

Answers to Multiple-Choice Questions

1. b
2. b
3. c
4. d
5. d
6. a
7. a
8. c
9. d
10. d

Answers to Numerical Response Questions

11.	216.6 g
12.	92.48%
13.	0.020 mol
14.	0.4800 g $O_2(g)$
15.	0.020 mol

Answers to Written Response Questions

16. Percentage yield = $\dfrac{\text{Experimental yield}}{\text{Predicted yield}} \times 100\%$

Errors that increase the experimental yield, increase the percentage yield; errors that decrease the experimental yield, decrease the percentage yield.

a) There are two possible answers.

(i) Tap water contains varying amounts of dissolved minerals. If the tap water contains large amounts of dissolved minerals, after drying, the precipitate will contain these minerals and will thus have a greater mass. This will increase the experimental yield and the percentage yield.

(ii) The precipitate might be slightly soluble in water and when it is rinsed with tap water, some of the precipitate might dissolve and be washed away. This possibility will result in a decreased experimental yield and percentage yield.

b) Some precipitate will be left on the stirring rod and not be included in the final weighing of the precipitate. This will decrease the experimental yield and the percentage yield.

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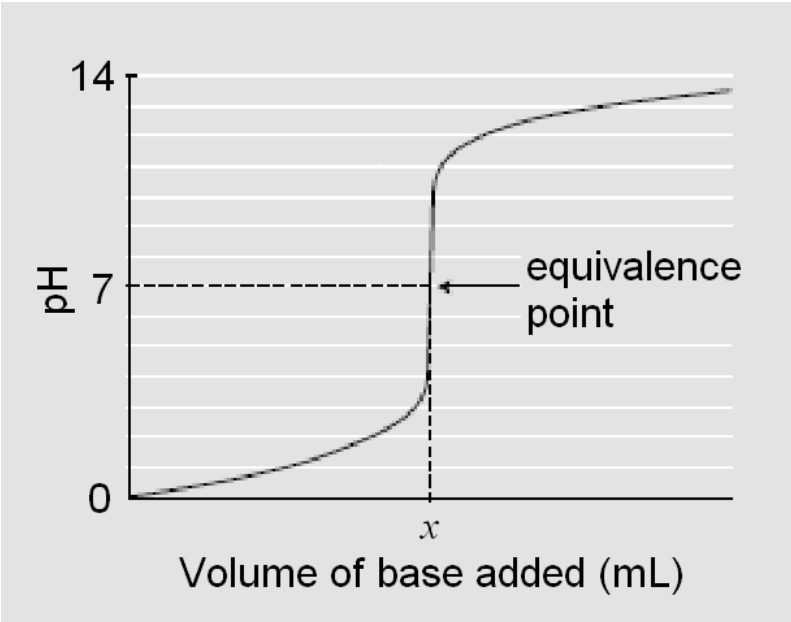
17. a) Since hydrochloric acid is a strong acid and sodium hydroxide is a strong base, the equivalence point will occur at pH = 7. The indicator bromothymol blue is a neutral green colour at pH = 7. The equivalence point will coincide with the endpoint.

b) A standard solution is one for which the exact concentration is known.

c) Rinsing with water ensures that reagents left from the last time the burette was used are washed away. A film of water will remain inside the burette that will have a slight diluting effect on the sodium hydroxide that is to be added. Rinsing the burette with sodium hydroxide ensures that the inside of the burette is coated with the same solution that is to be added, namely the NaOH(aq).

d) Titration curve for sample of toilet bowl cleaner



18. $n(\mathrm{Pb(NO_3)_2}) = c \times V = 0.200\ \frac{\mathrm{mol}}{\cancel{\mathrm{L}}} \times 0.375\ \cancel{\mathrm{L}} = 0.0750\ \mathrm{mol}$

$$0.0750\ \cancel{\mathrm{mol\ Pb(NO_3)_2}} \times \frac{1\ \mathrm{mol\ PbCrO_4}}{1\ \cancel{\mathrm{mol\ Pb(NO_3)_2}}} = 0.0750\ \mathrm{mol\ PbCrO_4}$$

$$n(\mathrm{K_2CrO_4}) = c \times V = 0.175\ \frac{\mathrm{mol}}{\cancel{\mathrm{L}}} \times 0.450\ \cancel{\mathrm{L}} = 0.07875\ \mathrm{mol}$$

$$0.07875\ \mathrm{mol\ K_2CrO_4(aq)} \times \frac{1\ \mathrm{mol\ PbCrO_4}}{1\ \mathrm{mol\ K_2CrO_4}} = 0.07875\ \mathrm{mol\ PbCrO_4}$$

Less $PbCrO_4$ was produced using $Pb(NO_3)_2(aq)$; thus $Pb(NO_3)_2(aq)$ is the limiting reagent.

$M(PbCrO_4) = 323.21$ g/mol

Predicted mass of $PbCrO_4$ = 0.0750 mol $PbCrO_4$ × 323.21g/mol = 24.2 g

19. a) Mass of Zn in sample = 0.900 × 15.0 g = 13.5 g

$M(\text{Zn}) = 65.41$ g/mol

$$n(\text{Zn}) = \frac{m}{M} = \frac{13.5\ \cancel{\text{g}}}{65.41\ \frac{\cancel{\text{g}}}{\text{mol}}} = 0.20639 \text{ mol}$$

$$n(\text{H}_2) = 0.20639 \text{ mol Zn(s)} \times \frac{1\,\text{mol H}_2}{1\,\text{mol Zn}} = 0.20639 \text{ mol H}_2\text{(g)}$$

$$n(\text{HCl}) = c \times V = 4.00\ \frac{\text{mol}}{\cancel{\text{L}}} \times 0.120\ \cancel{\text{L}} = 0.480 \text{ mol HCl(aq)}$$

$$n(\text{H}_2) = 0.300\ \cancel{\text{mol HCl}} \times \frac{1 \text{ mol H}_2}{2\ \cancel{\text{mol HCl}}} = 0.240 \text{ mol H}_2\text{(g)}$$

Less $H_2(g)$ is produced by the Zn(s), thus the Zn(s) is the limiting reagent.

Find volume of H_2 at 25.0 ^{o}C and 103.5 kPa.

$T = 25.0\ ^{o}\text{C} = 298.15$ K

$$V(\text{H}_2) = \frac{nRT}{P} = \frac{0.20639\ \cancel{\text{mol}} \times 8.314\ \frac{\text{L}\bullet\ \cancel{\text{kPa}}}{\cancel{\text{mol}}\bullet\cancel{\text{K}}} \times 298.15\ \cancel{\text{K}}}{103.5\ \cancel{\text{kPa}}} = 4.94 \text{ L}$$

b) $$\text{Percentage yield} = \frac{\text{Experimental}}{\text{Predicted}} \times 100\% = \frac{4.88\ \cancel{\text{L}}}{4.94\ \cancel{\text{L}}} \times 100\% = 98.8\%$$

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20. $n(\text{Cu}) = \dfrac{m}{M} = \dfrac{1000\ \cancel{\text{g}}}{63.55\ \dfrac{\cancel{\text{g}}}{\text{mol}}} = 15.7356 \text{ mol Cu}$

$\text{mol Ag produced} = 15.7356 \text{ mol Cu(s)} \times \dfrac{2 \text{ mol Ag}}{1 \text{ mol Cu}} = 31.47128 \text{ mol Ag}$

Predicted: $m(\text{Ag}) = nM = 31.47128\ \cancel{\text{mol}} \times 107.87\ \dfrac{\text{g}}{\cancel{\text{mol}}} = 3394.8 \text{ g} = 3.3948 \text{ kg}$

$\text{Percentage yield} = \dfrac{\text{Experimental}}{\text{Predicted}} \times 100\% = \dfrac{3.12\ \cancel{\text{kg}}}{3.3948\ \cancel{\text{kg}}} \times 100\% = 91.9\%$