C4.3 Mastery Quiz: Quantitative Chemistry

Section A

CHEMISTRY ONLY

1. Calculate the relative formula mass (M_r) of $FeBr_3$.

Relative atomic masses (A_r): Fe = 56 Br = 80

Tick (✓) **one** box. [1]

A. 136 ☐

B. 408 ☐

C. 296 ☐

2. Which ions do acids produce in aqueous solutions?

Tick (✓) **one** box. [1]

A. H^+ ☐

B. OH^- ☐

C. O^{2-} ☐

3. Acids react with alkalis. What is the name given to this type of reaction?

Tick (✓) **one** box. [1]

A. Decomposition ☐

B. Electrolysis ☐

C. Neutralisation ☐

D. Redox ☐

4. Universal indicator turns purple when added to potassium hydroxide solution. What is the pH of potassium hydroxide solution?

Tick (✓) **one** box. [1]

A. 1 ☐

B. 7 ☐

C. 14 ☐

5. Choose the correct state symbol for an aqueous solution. [1]

Tick (✓) **one** box.

A. (l) ☐

B. (s) ☐

C. (aq) ☐

6. 200 g sodium hydroxide was dissolved in water to make 1 dm^3 solution.

Choose the concentration of this sodium hydroxide solution. [1]

Tick (✓) **one** box.

A. 0.2 g/dm^3 ☐

B. 0.005 g/dm^3 ☐

C. 200 g/dm^3 ☐

7. How many atoms are present in one mole of fluorine atoms?

Tick (✓) **one** box. [1]

A. 19 ☐

B. 2.06×10^{23} ☐

C. 6.02×10^{23} ☐

8. Convert 250 cm^3 to dm^3.

Tick (✓) **one** box. [1]

A. 250 dm^3 ☐

B. 0.25 dm^3 ☐

C. 250000 dm^3 ☐

9. A student carried out an acid-base titration.

He placed a white tile under the conical flask before he started.

Why did he do this?

Tick (✓) **one** box. [1]

A. The white tile protects the desk from acid ☐

B. The white tile lifts up the conical flask so it is closer to the burette. ☐

C. The white tile allows the student to see any colour change clearly ☐

10. A student carried out a titration which involved a neutralisation reaction between sodium hydroxide solution and hydrochloric acid. She added the acid to the burette, and the alkali to a conical flask. She carefully added the acid to the conical flask until the alkali was neutralised.

This was repeated 5 times.

The table below displays the students results.

Titre	**Volume of acid required to neutralise the alkali (cm^3)**
1	21.4
2	21.5
3	20.5
4	21.1
5	21.4

Calculate the average titre.

Tick (✓) **one** box. [1]

A. 21.22 ☐

B. 21.43 ☐

C. 21.35 ☐

HIGHER TIER ONLY

11. A mixture contains 50 g of aluminium and 150 g of iron oxide.

The equation for the reaction is:

$$2Al + Fe_2O_3 \rightarrow 2Fe + Al_2O_3$$

Which is the limiting reactant?

Relative atomic masses (Ar): O = 16 Al = 27 Fe = 56

Tick (✓) **one** box. [1]

A. Aluminium ☐

B. Iron Oxide ☐

C. Iron ☐

12. Select the **correct** statement.

Tick (✓) **one** box. [1]

A. Ethanoic acid is a weak acid, because it partially ionises in an aqueous solution. ☐

B. Sulfuric acid is a strong acid because it partially ionises in an aqueous solution. ☐

C. Ethanoic acid is a strong acid because it fully ionises in an aqueous solution. ☐

13. Which of the following statements correctly describes a **concentrated** acid?

Tick (✓) **one** box. [1]

A. Little or no water molecules are mixed with the acid molecules. The concentration of H^+ ions is low. ☐

B. Little or no water molecules are mixed with the acid molecules. The concentration of H^+ ions is high. ☐

C. Many water molecules are mixed with the acid molecules. The concentration of H^+ ions is low. ☐

14. Ethanedioic acid ($H_2C_2O_4$) is a solid at room temperature.

Calculate the mass of ethanedioic acid equal to 0.048 moles.

Relative formula mass (M_r): $H_2C_2O_4 = 90$

Tick (✓) **one** box. [1]

A. 4.32 g ☐

B. 0.0005 g ☐

C. 1875 g ☐

15. What mass of ethanedioic acid ($H_2C_2O_4$) is needed to make 0.25 dm^3 of a solution with concentration 0.05 mol/dm^3?

Relative formula mass (M_r): $H_2C_2O_4 = 90$

Tick (✓) **one** box. [1]

A. 18 g ☐

B. 1.125 g ☐

C. 0.0125 g ☐

16. A student found that 25.0 cm^3 of sodium hydroxide solution was neutralised by 15.00 cm^3 of 0.0480 mol/dm^3 ethanedioic acid solution.

The equation for the reaction is:

$$H_2C_2O_4 + 2\ NaOH \rightarrow Na_2C_2O_4 + 2\ H_2O$$

0.00072 moles of ethanedioic acid reacted.

a. Use the equation provided to calculate the number of moles of sodium hydroxide solution that reacted.

Tick (✓) **one** box. [1]

A. 0.00072 moles ☐

B. 0.00036 moles ☐

C. 0.00144 moles ☐

b. Another student carried out the same reaction. They reacted 0.5 moles of sodium hydroxide solution with ethanedioic acid. The volume of sodium hydroxide solution reacted was 25.0 cm^3.

Calculate the concentration of the sodium hydroxide solution in mol/dm^3

Tick (✓) **one** box. [1]

A. 20 mol/dm^3 ☐

B. 0.02 mol/dm^3 ☐

C. 0.0125 mol/dm^3 ☐

17. Two balloons are filled with a gas. Both balloons are at standard room temperature and pressure.

Balloon A
Filled with 10 g of hydrogen gas (H_2)

Balloon B
Filled with 20 g of helium gas (He)

Relative formula mass (M_r): H = 1 He = 4

Which statement below is correct?

Tick (✓) **one** box. [1]

A. Balloon A will have a greater volume ☐

B. Balloon B will have a greater volume ☐

C. The balloons will have the same volume ☐

Section B

1. (a) A student carried out an acid-base titration.

She used the following equipment:

- A pipette
- 25 cm^3 of potassium hydroxide solution
- A conical flask
- Indicator
- A burette filled with sulfuric acid

Describe how the student could use the equipment listed above to complete the titration.

_____

_____

_____

_____

_____

_____

_____

_____

[5]

(b) Hydrochloric acid (HCl) is a strong acid.

What ions do all acids produce in aqueous solutions?

_____ [1]

(c) The student added a few drops of universal indicator to the hydrochloric acid.

What colour will she observe?

_____ [1]

HIGHER TIER ONLY

1. A student wanted to make 11.5 g of sodium chloride.

The equation for the reaction is:

$$Na_2CO_3(aq) + 2HCl(aq) \longrightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$

Relative atomic masses, A_r: H = 1; C = 12; O = 16; Cl = 35.5; Na = 23

(a) Calculate the mass of sodium carbonate the student should react with dilute hydrochloric acid to make 11.5 g of sodium chloride.

_____

_____

_____

_____

Mass of sodium carbonate = _____ g

[5]

(b) Another student carried out this reaction and produced 36 g of water.

Calculate the number of moles of water he produced.

_____

_____

Number of moles = _____

[1]

(c) The acid used in this reaction has a concentration of 1.0×10^{-3} mol/dm^3. It has a pH of 2.

What is the pH of a solution of the same acid, with a concentration of 1.0×10^{-5} mol/dm^3?

_____

_____

pH = _____

[2]

(d) The carbon dioxide was collected at room temperature and pressure.
The volume of one mole of any gas at room temperature and pressure is 24.0 dm^3.

How many moles of carbon dioxide is in 45 cm^3?

Give your answer in three significant figures.

_____

_____

_____

_____

= _____ mol

[3]