C4.3 Mastery Quiz: Quantitative Chemistry

Section A

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 alkalis 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. Which is

likely to be the pH of potassium hydroxide solution?

Tick (✓) **one** box. [1]

A. 1 ☐

B. 7 ☐

C. 14 ☐

5. Below shows a chemical formula of a compound.

$CaCO_3$

Choose the correct number of atoms in one molecule. [1]

Tick (✓) **one** box.

A. 1 calcium atom, 1 carbon atom, 3 oxygen atoms ☐

B. 1 calcium atom, 3 carbonate atoms ☐

C. 3 calcium atoms, 3 carbon atoms, 3 oxygen atoms ☐

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

Tick (✓) **one** box.

A. (l) ☐

B. (s) ☐

C. (aq) ☐

7. Below shows a symbol equation of a chemical reaction.

$$CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$$

When this reaction was carried out in a beaker on a balance, the mass decreased.

Choose the best explanation for why. [1]

Tick (✓) **one** box.

A. Carbon dioxide gas is produced which has no mass ☐

B. Carbon dioxide gas left the beaker ☐

C. Reactants always have a greater mass than the products formed ☐

8. Below shows an incomplete word equation for a chemical reaction.

Calcium carbonate + hydrochloric acid → carbon dioxide + _____ + water

Choose the missing substance. [1]

Tick (✓) **one** box.

A. Chlorine carbonate ☐

B. Calcium chloride ☐

C. Hydrocarbonate ☐

9. 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 ☐

HIGHER TIER ONLY

10. 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} ☐

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

Tick (✓) **one** box. [1]

A. 250 dm^3 ☐

B. 0.25 dm^3 ☐

C. 250000 dm^3 ☐

12. 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 ☐

13. 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. ☐

14. 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. ☐

15. 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 ☐

Section B

1. A student investigated the law of conservation of mass.

This is the method the student used.

1. Pour sodium carbonate solution into beaker A and pour hydrochloric acid solution into beaker B.
3. Place each beaker on a balance to measure the mass of the beakers and their contents.
4. Pour the solution from beaker B into beaker A.
5. Measure the mass of both beakers and contents again.

This is the equation for the reaction that takes place:

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

(a) State the law of conservation of mass.

_____

_____

[1]

(b) The table shows the student's results.

	Mass in g
Beaker A and contents before mixing	68.76
Beaker B and contents before mixing	72.12
Beaker A and contents after mixing	79.23
Beaker B after mixing	56.65

Explain why this reaction does not appear to obey the law of conservation of mass.

_____

_____

_____

[2]

(c) What is the resolution of the balance used to obtain the results in the table?

Tick (✓) **one** box.

0.01 g ☐ 0.1 g ☐ 1 g ☐ 100 g ☐

[1]

(d) Calculate the relative formula mass (M_r) of sodium carbonate Na_2CO_3

Relative atomic masses (A_r): Na = 23 O = 16 C = 12

_____

_____

Relative formula mass = _____

[2]

(e) What is the percentage by mass of sodium in sodium carbonate (Na_2CO_3)?

_____

_____

_____

Percentage = _____

[2]

(f) The formula of lithium chromate is Na_2CO_3

The charge on a sodium ion is +1

What is the formula of the carbonate ion?

Tick (✓) **one** box.

CO_3^{+} ☐

CO_3^{2+} ☐

CO_3^{-} ☐

CO_3^{2-} ☐

[1]

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

What ions do all acids produce in aqueous solutions?

_____

[1]

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

What colour will she observe?

_____

[1]

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2. 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) 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]