Acids, bases and salts – 2019 June

1. 0620/41/M/J/19/No.4

Ethanoic acid is a weak acid and hydrochloric acid is a strong acid.
Both ethanoic acid and hydrochloric acid dissociate in aqueous solution.

(a) (i) Define the term *acid*.

..... [1]

(ii) The chemical equation shows the changes which occur when the **strong** acid, hydrochloric acid, is added to water.

$$HCl(aq) \rightarrow H^+(aq) + Cl^-(aq)$$

Complete the chemical equation to show the changes which occur when the **weak** acid, ethanoic acid, is added to water.

$CH_3COOH(aq)$ ..... [2]

(b) A student does experiments to show that hydrochloric acid is a strong acid and ethanoic acid is a weak acid. The student adds an excess of hydrochloric acid and an excess of ethanoic acid to separate samples of lumps of calcium carbonate.

Only the identity of the acid is changed between the experiments. All other conditions are kept the same.

(i) State **two** observations which would show that hydrochloric acid is a stronger acid than ethanoic acid.

1 .....

2 .....
[2]

(ii) The student uses the same size container and checks that the pressure is the same for each experiment.

State **three** other conditions which must be kept the same to ensure fair testing.

1 .....

2 .....

3 .....
[3]

(c) Hydrochloric acid produces salts called chlorides.

Magnesium carbonate reacts with hydrochloric acid to produce magnesium chloride.

$$MgCO_3 + 2HCl \rightarrow MgCl_2 + H_2O + CO_2$$

A student used 50.00 cm^3 of 2.00 mol/dm^3 hydrochloric acid in an experiment to produce magnesium chloride.

Calculate the mass, in g, of magnesium carbonate needed to react exactly with 50.00 cm^3 of 2.00 mol/dm^3 hydrochloric acid using the following steps.

- Calculate the number of moles of HCl present in 50.00 cm^3 of 2.00 mol/dm^3 HCl.

..... mol

- Determine the number of moles of $MgCO_3$ which would react with 50.00 cm^3 of 2.00 mol/dm^3 HCl.

..... mol

- Calculate the relative formula mass, M_r, of $MgCO_3$.

M_r of $MgCO_3$ = ...

- Calculate the mass of $MgCO_3$ needed to react exactly with 50.00 cm^3 of 2.00 mol/dm^3 HCl.

mass = ... g

[4]

(d) A student prepares crystals of magnesium chloride by adding an excess of magnesium carbonate to 50.00 cm^3 of 2.00 mol/dm^3 hydrochloric acid.

The student filters the mixture and rinses the residue.

(i) Why does the student add an **excess** of magnesium carbonate?

..... [1]

(ii) Why does the student rinse the residue?

..... [1]

(iii) Describe how the student would obtain pure crystals of magnesium chloride from the filtrate.

.....

.....

..... [3]

(e) Silver chloride, AgC*l*, is insoluble. It can be made by a precipitation reaction between aqueous barium chloride and a suitable aqueous silver salt.

(i) What is meant by the term *precipitate*?

.....

..... [2]

(ii) Name a suitable silver salt to use to prepare silver chloride.
Complete the chemical equation to show the formation of insoluble silver chloride from aqueous barium chloride and the silver salt you have named.

name of a suitable silver salt .....

$BaCl_2$ + ... → ..... + ...

[3]

[Total: 22]

2. 0620/32/F/M/19/No.5

Aqueous sodium hydroxide is a base.

(a) Describe the reaction of aqueous sodium hydroxide with:

- a named acid

.....

.....

.....

- ammonium salts

.....

.....

.....

- a named indicator.

.....

.....

.....

[5]

(b) Ammonia is a soluble base.

Which **one** of the following pH values could be the pH of aqueous ammonia?
Draw a circle around the correct answer.

pH 1 pH 5 pH 7 pH 10 [1]

(c) Ammonia is used in the manufacture of some fertilisers.

Which **two** of these compounds are present in fertilisers?
Tick **two** boxes.

copper(II) oxide	☐
potassium chloride	☐
sodium phosphate	☐
strontium fluoride	☐
sulfur dioxide	☐

[2]

(d) Bacteria in the soil are able to convert ammonium compounds into oxides of nitrogen. The oxides of nitrogen can escape into the atmosphere.

(i) State **one** other source of oxides of nitrogen in the atmosphere.

..... [1]

(ii) State **one** effect of oxides of nitrogen on health.

..... [1]

(iii) Oxides of nitrogen are greenhouse gases which contribute to climate change.

Give the name of **one** other greenhouse gas which makes a major contribution to climate change.

..... [1]

[Total: 11]