20 Which statement describes a property of ethanoic acid?

A It does **not** produce carbon dioxide when added to sodium carbonate.

B It does **not** produce hydrogen when added to magnesium.

C It only donates some of its protons when added to excess aqueous sodium hydroxide.

D It only partially dissociates when added to water.

22 The equation shows the reaction between aqueous hydrogen bromide and aqueous ammonia.

$$HBr(aq) + NH_3(aq) \rightarrow NH_4^+(aq) + Br^-(aq)$$

Which statement describes the role of aqueous hydrogen bromide?

A It is a catalyst.

B It is a reducing agent.

C It is a proton acceptor.

D It is a proton donor.

21 Which statement describes a base?

A It reacts with ammonium chloride to produce ammonia gas.

B It reacts with calcium carbonate to produce carbon dioxide gas.

C It reacts with copper to produce hydrogen gas.

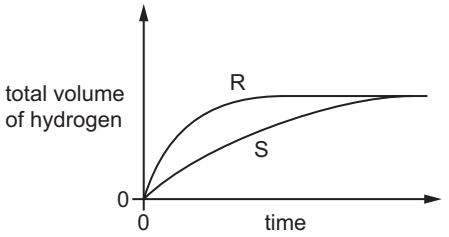
D It turns blue litmus red.

24 Dilute acid R and dilute acid S have the same concentration.

The same volume of each dilute acid is reacted separately with the same mass of magnesium ribbon. Both reactions are carried out at room temperature and pressure.

The volume of hydrogen produced is measured.

A graph of the results is shown.



Which statement about the reactions is correct?

A Acid S reacts faster than acid R.

B The final volume of hydrogen produced in each reaction is different.

C Acid R is a stronger acid than acid S.

D Acid S is a stronger acid than acid R.

34 Which statement about aqueous ethanoic acid is correct?

A It reacts with magnesium to form oxygen gas.

B It reacts with sodium carbonate to form carbon dioxide gas.

C It turns red litmus paper blue.

D It turns methyl orange yellow.

4 Nitric acid, HNO_3, and sulfuric acid, H_2SO_4, are strong acids. Ethanoic acid, CH_3COOH, is a weak acid.

(a) One mole of each acid is added separately to 1000 cm^3 of distilled water to form a dilute solution. All three acids dissociate in distilled water.

(i) State the formula of the common cation produced when each of the three acids dissociates in water.

..... [1]

(ii) Explain, in terms of dissociation, why:

- nitric acid is described as a strong acid

.....

- ethanoic acid is described as a weak acid.

.....
[2]

(iii) State which of the three dilute acids will have the highest pH value.

..... [1]

(iv) State the colour of thymolphthalein in all three dilute acids.

..... [1]

(v) Give the formula of the anion formed when:

- sulfuric acid dissociates in water

.....

- ethanoic acid dissociates in water.

.....
[2]

(vi) Name the **two** gaseous products formed during the electrolysis of dilute sulfuric acid using inert electrodes.

..... and ..... [2]

(vii) Name the salt formed when calcium reacts with ethanoic acid.

..... [1]

(b) Aluminium nitrate, $Al(NO_3)_3$, is made when dilute nitric acid reacts with aluminium hydroxide, $Al(OH)_3$.

(i) $Al(OH)_3$ acts as a base in this reaction.

Define the term base.

..... [1]

(ii) $Al(OH)_3$ is **not** an alkali.

State what this tells you about the solubility of $Al(OH)_3$.

..... [1]

(iii) Name **one other** compound which forms aluminium nitrate when added to dilute nitric acid.

..... [1]

(iv) The oxidation number of the O atoms in $Al(NO_3)_3$ is –2.
The formula of the aluminium ion in $Al(NO_3)_3$ is Al^{3+}.

Determine the oxidation number of the N atoms in $Al(NO_3)_3$.
Show your working.

oxidation number of N = ... [2]

[Total: 15]

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18 Two experiments involving acids R or S are done.

- 0.10 mol of acid R completely dissolves in 500 cm^3 of water. 0.0048 mol of acid R is dissociated in the solution.
- 0.10 mol of acid S completely dissolves in 500 cm^3 of water. 0.0179 mol of acid S is dissociated in the solution.

Which statement about acids R and S is correct?

A Acid R is a strong acid, and acid S is a weak acid.

B Acid R is a weak acid, and acid S is a strong acid.

C Acid R and acid S are both strong acids.

D Acid R and acid S are both weak acids.

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19 Which row shows the equations for the dissociation of hydrochloric acid and of ethanoic acid in aqueous solution?

	hydrochloric acid	ethanoic acid
A	$HCl(aq) \rightarrow H^+(aq) + Cl^-(aq)$	$CH_3COOH(aq) \rightleftharpoons H^+(aq) + CH_3COO^-(aq)$
B	$HCl(aq) \rightleftharpoons H^+(aq) + Cl^-(aq)$	$CH_3COOH(aq) \rightleftharpoons H^+(aq) + CH_3COO^-(aq)$
C	$HCl(aq) \rightarrow H^+(aq) + Cl^-(aq)$	$CH_3COOH(aq) \rightarrow H^+(aq) + CH_3COO^-(aq)$
D	$HCl(aq) \rightleftharpoons H^+(aq) + Cl^-(aq)$	$CH_3COOH(aq) \rightarrow H^+(aq) + CH_3COO^-(aq)$

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22 Some information about two dilute acids is shown.

dilute acid	acid concentration in mol / dm^3	pH
nitric acid	0.1	1.0
propanoic acid	0.4	2.6

Three statements about the acids are listed.

1 Nitric acid has a lower pH because it dissociates more than propanoic acid.

2 Propanoic acid has a lower concentration of hydrogen ions than nitric acid.

3 Propanoic acid has a higher pH because it has a higher concentration.

Which statements are correct?

A 1 and 2 **B** 1 and 3 **C** 2 only **D** 3 only