Chemistry

Teacher: - Mubashir Sulehri

Chapter

Acids, bases and alkalis

Work Sheet
Paper *1*

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1   Hydrogen chloride is a compound.

   (i)   Draw a diagram to show how the electrons are arranged in a molecule of hydrogen chloride.

         Show only the outer electrons.

                                                        show hydrogen electrons as •
                                                        show chlorine electrons as   x

         .... [2]

   (ii) State the name of the type of bonding present in hydrogen chloride.

         .... [1]

   (iii) Hydrogen chloride dissolves in water to form an acidic solution (hydrochloric acid). Describe how you would use litmus paper to show that this solution is acidic.

         ....

         .... [2]

   (iv) Which one of the following values is most likely to represent the pH of a dilute solution of hydrochloric acid?

         Put a ring around the correct answer.

   pH 2   **pH7**   **pH10**   **pH14**   [1]

2   Sulfamic acid, SO_3NH_3, is a weak acid used to remove limescale from kettles.

   (a) Explain the meaning of the term *weak acid*?

         ....

         ....[1]

(b) The pH of an aqueous solution of sulfamic acid can be determined using a pH meter. Describe another way of estimating the pH of a solution of sulfamic acid.

....

....

....[2]

3 Propanoic acid, $C_2H_5CO_2H$, and hydrochloric acid, HCl, both act as acids when dissolved in water.

(a) State the formula of an ion found in both dilute propanoic acid and in dilute hydrochloric acid.

....[1]

(b) Propanoic acid reacts with magnesium carbonate to form water, a colourless gas and a salt. In this reaction

(i) name the gas,

....[1]

(ii) give the formula of the salt.

....[1]

4 Sulfuric acid is a strong acid. Ethanoic acid is a weak acid.

(a) What do you understand by the terms *strong acid* and *weak acid*?

....

....

.... [1]

(b) Compare and explain the difference in the electrical conductivity between a strong and a weak acid.

.... [1]

5 Hydrochloric acid can be made by burning hydrogen in chlorine, then dissolving the product in water.
Give the formulae for the ions present in hydrochloric acid.

....[1]

Write the equation for the reaction of magnesium with ethanoic acid, CH_3COOH.

6   Methylamine, CH_3NH_2, is a base which has similar properties to ammonia.
When methylamine dissolves in water, the following equilibrium is set up.

$$CH_3NH_2 \; + \; H_2O \; \rightleftharpoons \; CH_3NH_3^+ \; + \; OH^-$$
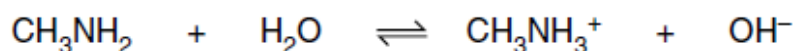
(a) Explain why methylamine behaves as a base in this reaction.

....

7   Hydrogen iodide reacts with water to form a strong acid, hydriodic acid, HI(aq).

(i)   What is meant by the term *strong acid*?

....

....[1]

(ii)   Construct the equation for the dissociation of hydrogen iodide molecules into ions.

....[1]

8   Choose from the following solutions to answer the questions below.

$CuSO_4(aq)$ $KCl(aq)$ $K_2Cr_2O_7(aq)$ $KI(aq)$

$KMnO_4(aq)$ $MgSO_4(aq)$ $NH_3(aq)$ $ZnSO_4(aq)$

Each solution can be used once, more than once, or not at all.

Write the formula for a solution which

(a) is alkaline,

.... [1]

9   Choose from the following gases to answer the questions below.

<div align="center">

ammonia

argon

carbon monoxide

chlorine

hydrogen

nitrogen

nitrogen dioxide

oxygen

</div>

Each gas can be used once, more than once or not at all.

Name a gas which
dissolves in water to make an alkaline solution,

....[1]

10 The table shows the concentration of different ions found in a sample of aqueous industrial waste.

ion	concentration in mol/dm³
Ca^{2+}	0.125
H^+	2.30
K^+	0.234
NO_3^-	3.68
Fe^{2+}	0.450

Use the information in the table to answer the following questions.

(a) Write the formula of one salt that could be obtained from the sample.

....[1]

(b) Is the sample of aqueous waste acidic, neutral or alkaline? Explain your answer.

....

....[1]

11 Hydrogen iodide dissolves in water to form hydroiodic acid, HI(aq).

Hydroiodic acid is a strong acid.

(i) Write an equation to show the dissociation of hydroiodic acid.

....[1]

(ii) Hydroiodic acid reacts with calcium.

Write the equation for this reaction.

....[1]

(iii) Hydroiodic acid reacts with sodium carbonate.

Write the ionic equation for this reaction.

....[1]

12 A student adds aqueous sodium hydroxide from a burette into $25.0\,cm^3$ of dilute sulphuric acid. The student measures the pH value of the mixture during the addition of the sodium hydroxide.

(a) Describe how the pH value changes.

....[1]

(b) Give an ionic equation to represent the neutralisation reaction between sodium hydroxide and sulphuric acid.

....[1]

(c) Sulphuric acid is a strong acid.

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

....

....

(ii) What is the difference between a strong acid and a weak acid?

....

....

....

[3]

(d) Dilute sulphuric acid reacts with magnesium to give hydrogen.
Give the ionic equation for this reaction.

....[1]

13 A toilet cleaner contains the acid salt, sodium dihydrogen phosphate, NaH_2PO_4.

(a) Explain why sodium dihydrogen phosphate is both an 'acid' and a 'salt'.　　　[2]

(b) Sodium dihydrogen phosphate can be made by reacting sodium hydroxide with phosphoric acid, H_3PO_4.

(i) Write an equation for the formation of sodium dihydrogen phosphate.

(ii) Suggest the formula of **two** other salts formed from sodium hydroxide and phosphoric acid.　　　[3]

(c) The table shows information about other acidic compounds.

name	pH of a 0.5 mol/dm³ solution	
sodium dihydrogen phosphate	4.5	increasing acid strength
ethanoic acid	3.8	
sulphuric acid	1.0	

(i) Explain why sulphuric acid behaves as a *strong acid* but ethanoic acid behaves as a *weak acid*.

(ii) Describe an experiment, other than measuring pH, that you could carry out to show that sulphuric acid is a strong acid but ethanoic acid is a weak acid.

State what measurements you would make and what results you would expect. [5]

14 Sulfuric acid is a strong acid.

(a) (i) What is meant by the term *strong acid*?

....[1]

(ii) Describe how you could measure the pH of dilute sulfuric acid.

....

....[1]
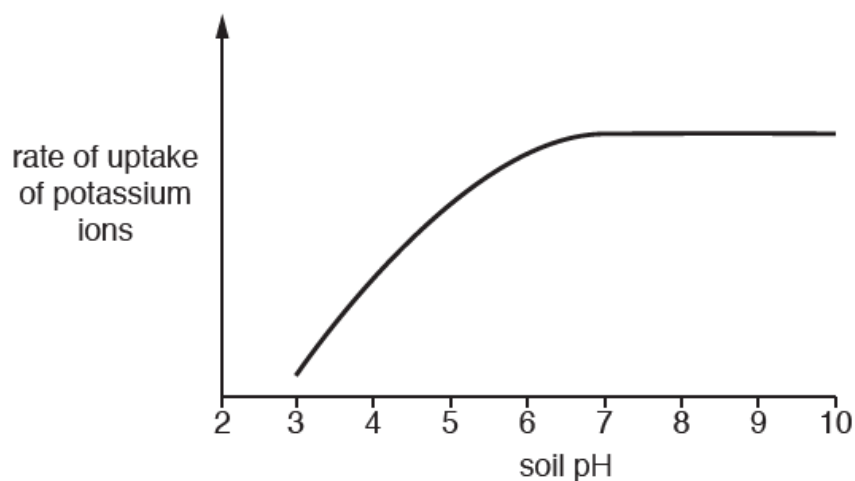
(b) Many plants cannot grow in soils which are too acidic.

Describe and explain how soils which are too acidic can be treated to reduce the acidity.

....

....

....[2]

(c) The graph shows the effect of soil pH on the rate of uptake of potassium ions by plant roots.

Describe how the rate of uptake of potassium ions varies with soil pH.

....

....[1]

[Total: 5]

15   Sulfamic acid has the structure shown.

$$\begin{array}{ccc} H & O & H \\ \diagdown & \| & \diagup \\ N\!-\!\!\!\!& S & \!\!\!-O \\ \diagup & \| & \\ H & O & \end{array}$$
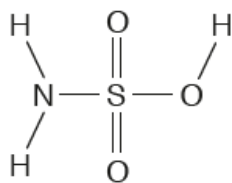
(a) Write the molecular formula for sulfamic acid.

....[1]

(b) Sulfamic acid is a weak acid.

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

....

....[1]

(ii) What is the difference between a weak acid and a strong acid?

....

....

....

....[2]

(c) What mass of sulfamic acid is required to make $250 \, cm^3$ of a $0.150 \, mol/dm^3$ solution?

mass .... g [3]

(d) In a titration, 0.00250 moles of NaOH is exactly neutralised by 0.150 mol/dm^3 sulfamic acid.

One mole of sodium hydroxide reacts with one mole of sulfamic acid.

Calculate the volume, in cm^3, of sulfamic acid needed in this titration.

volume .... cm^3 [1]

(e) One mole of aqueous sulfamic acid can produce one mole of hydrogen ions.

Construct the equation to show the reaction between sulfamic acid and magnesium.

....[2]

[Total: 10]

The Periodic Table of Elements

Group

Key

atomic number
atomic symbol
name
relative atomic mass

I	II											III	IV	V	VI	VII	VIII
								1 **H** hydrogen 1									2 **He** helium 4
3 **Li** lithium 7	4 **Be** beryllium 9											5 **B** boron 11	6 **C** carbon 12	7 **N** nitrogen 14	8 **O** oxygen 16	9 **F** fluorine 19	10 **Ne** neon 20
11 **Na** sodium 23	12 **Mg** magnesium 24											13 **Al** aluminium 27	14 **Si** silicon 28	15 **P** phosphorus 31	16 **S** sulfur 32	17 **Cl** chlorine 35.5	18 **Ar** argon 40
19 **K** potassium 39	20 **Ca** calcium 40	21 **Sc** scandium 45	22 **Ti** titanium 48	23 **V** vanadium 51	24 **Cr** chromium 52	25 **Mn** manganese 55	26 **Fe** iron 56	27 **Co** cobalt 59	28 **Ni** nickel 59	29 **Cu** copper 64	30 **Zn** zinc 65	31 **Ga** gallium 70	32 **Ge** germanium 73	33 **As** arsenic 75	34 **Se** selenium 79	35 **Br** bromine 80	36 **Kr** krypton 84
37 **Rb** rubidium 85	38 **Sr** strontium 88	39 **Y** yttrium 89	40 **Zr** zirconium 91	41 **Nb** niobium 93	42 **Mo** molybdenum 96	43 **Tc** technetium –	44 **Ru** ruthenium 101	45 **Rh** rhodium 103	46 **Pd** palladium 106	47 **Ag** silver 108	48 **Cd** cadmium 112	49 **In** indium 115	50 **Sn** tin 119	51 **Sb** antimony 122	52 **Te** tellurium 128	53 **I** iodine 127	54 **Xe** xenon 131
55 **Cs** caesium 133	56 **Ba** barium 137	57–71 lanthanoids	72 **Hf** hafnium 178	73 **Ta** tantalum 181	74 **W** tungsten 184	75 **Re** rhenium 186	76 **Os** osmium 190	77 **Ir** iridium 192	78 **Pt** platinum 195	79 **Au** gold 197	80 **Hg** mercury 201	81 **Tl** thallium 204	82 **Pb** lead 207	83 **Bi** bismuth 209	84 **Po** polonium –	85 **At** astatine –	86 **Rn** radon –
87 **Fr** francium –	88 **Ra** radium –	89–103 actinoids	104 **Rf** rutherfordium –	105 **Db** dubnium –	106 **Sg** seaborgium –	107 **Bh** bohrium –	108 **Hs** hassium –	109 **Mt** meitnerium –	110 **Ds** darmstadtium –	111 **Rg** roentgenium –	112 **Cn** copernicium –		114 **Fl** flerovium –		116 **Lv** livermorium –		

lanthanoids	57 **La** lanthanum 139	58 **Ce** cerium 140	59 **Pr** praseodymium 141	60 **Nd** neodymium 144	61 **Pm** promethium –	62 **Sm** samarium 150	63 **Eu** europium 152	64 **Gd** gadolinium 157	65 **Tb** terbium 159	66 **Dy** dysprosium 163	67 **Ho** holmium 165	68 **Er** erbium 167	69 **Tm** thulium 169	70 **Yb** ytterbium 173	71 **Lu** lutetium 175
actinoids	89 **Ac** actinium –	90 **Th** thorium 232	91 **Pa** protactinium 231	92 **U** uranium 238	93 **Np** neptunium –	94 **Pu** plutonium –	95 **Am** americium –	96 **Cm** curium –	97 **Bk** berkelium –	98 **Cf** californium –	99 **Es** einsteinium –	100 **Fm** fermium –	101 **Md** mendelevium –	102 **No** nobelium –	103 **Lr** lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

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