**Unit 2 Test 2 Acids and bases Student name: \_\_\_\_\_\_\_\_\_\_\_\_**

**SECTION A – Multiple-choice questions**

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| **Instructions for Section A**  Answer **all** questions.  Choose the response that is **correct** or **best answers** the question.  A correct answer scores 1, an incorrect answer scores 0.  No mark will be given if more than one answer is completed for any question.  Marks will **not** be deducted for incorrect answers. |

**Question 1**

Which of the following can be used to verify that a liquid is a basic (alkaline) solution?

**A**. Add blue litmus – it will only stay blue if the liquid is basic.

**B**. Add magnesium – if no gas is evolved the liquid must be basic.

**C**. Add red litmus – it will turn blue.

**D**. Add calcium carbonate – the liquid is basic if no reaction occurs.

**Question 2**

The Bronsted-Lowry definition of an acid is a

**A**. substance that can donate a proton.

**B**. substance that will react with an acid.

**C**. substance that can accept a proton.

**D**. substance that can donate electrons.

**Question 3**

Select the list that contains acids only.

**A**. HCl, NaOH, CH4, CH3COOH

**B**. HCl, H2O, CH4, HF

**C**. HCl, NH3, CH4, CH3COOH

**D**. HCl, HNO3, HF, CH3COOH

**Question 4**

The conjugate base of the ammonium ion, NH4+ is

**A**. NH4+

**B**. NH3

**C**. NH2-

**D**. N3-

**Question 5**

Water molecules can react with each other. When they do, a solution is formed that

**A**. dissociates to hydrogen gas and oxygen gas.

**B**. contains H3O+ and OH- ions that will conduct electricity slightly.

**C**. contains H3O+ and OH- ions but will not conduct electricity.

**D**. ionises to form H3O+ ions only.

*Use the following information to answer Questions 6 and 7*

|  |  |  |
| --- | --- | --- |
| Solution | [H3O+] | pH |
| A | 0.1 M | 1 |
| B | 0.01 M | 2 |
| C | 0.01 M | 4.5 |
| D | 0.001 M | 2.7 |

**Question 6**

The solution from the table that is a weak acid is solution

**A**. A

**B**. B

**C**. C

**D**. D

**Question 7**

The solution from the table that is a diprotic acid is

**A**. A

**B**. B

**C**. C

**D**. D

**Question 8**

Select the correct statement about acid-base indicators.

**A**. The conjugate acid form of the indicator has a different colour to the conjugate base.

**B**. All indicators are natural substances.

**C**. They change colour at pH 7.

**D**. They always turn red in strong acids.

**Question 9**

The solution in the diagram is a representation of

HI HI HI

I-

H3O+ I- HI

HI HI HI H3O+

**A**. a strong acid.

**B**. a weak acid.

**C**. a weak base.

**D**. a strong base.

**Question 10**

As the concentration of CO2 gas in the atmosphere increases, the

**A**. ocean is becoming strongly acidic.

**B**. concentration of dissolved CO2 rises causing higher levels of precipitation of CaCO3.

**C**. concentration of dissolved CO2 in the ocean rises and the pH rises.

**D**. concentration of dissolved CO2 in the ocean rises and the pH drops.

**SECTION B- Short-answer questions**

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| **Instructions for Section B**  Questions must be answered in the spaces provided in this book. To obtain full marks for your responses you should   * Give simplified answers with an appropriate number of significant figures to all numerical questions; unsimplified answers will not be given full marks. * Show all workings in your answers to numerical questions. No credit will be given for an incorrect answer unless it is accompanied by details of the working.   Make sure chemical equations are balanced and that the formulas for individual substances include an indication of state; for example, H2(g); NaCl(s) |

**Question 1** (10 marks)

**a**. Complete the table below by labelling each chemical as acid, base or neither. 3 marks

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| KOH | HNO3 | CH4 | CH3COOH | Mg(OH)2 |
|  |  |  |  |  |

**b. i**. What is the Bronsted-Lowry definition of an acid? 1 mark

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**ii**. Use this definition to write an equation that shows HSO4- acting as an acid in water. 1 mark

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**c**. HSO4- is an example of an amphiprotic substance.

**i**. What does amphiprotic mean? 1 mark

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**ii**. Write an equation that shows HSO4- acting as a base in water. 1 mark

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**d**. Nitric acid is an example of an acid. List the properties you would expect nitric acid to have.

2 marks

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**e**. Is every compound that contains hydrogen an acid? Give examples to justify your answer. 1 mark

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**Question 2** (7 marks)

Acids have characteristic reactions with categories of reactants.

**a. i**. Write a balanced equation for the reaction of zinc metal in hydrochloric acid. 1 mark

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**ii**. What would you observe if watching this reaction? 1 mark

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**ii**. In general, what are the products of a reaction between an acid and a metal? 1 mark

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**b. i**. Write a balanced equation for the reaction between zinc carbonate powder, ZnCO3 and

hydrochloric acid. 1 mark

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**ii**. What is the general equation for the reaction of an acid and a carbonate? 1 mark

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**c. i**. Write a balanced equation for the reaction between hydrochloric acid and lithium

hydroxide, LiOH. 1 mark

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**ii**. This is described as a neutralization reaction. What does that mean? 1 mark

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**Question 3** (5 marks)

The scale used for measuring acidity is the pH scale.

|  |  |  |
| --- | --- | --- |
| Solution | [H3O+] | pH |
| 0.01 M HCl |  |  |
| 0.05 M HCl |  |  |
| 0.01 M NaOH |  |  |
| Water at 25 0C |  |  |
| 0.05 M Mg(OH)2 |  |  |

Complete the table by filling in the blank cells.

**Question 4** (5 marks)

Sulfuric acid is a diprotic acid.

**a. i**. Write two equations to show the two steps in the reaction of sulfuric acid in water. 2 marks

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**ii**. Write an overall equation for this reaction. 1 mark

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**b**. The pH of a 0.1 M solution of HCl is 1. Explain why the pH of a 0.1 M solution of sulfuric

acid will not be 1. 2 marks

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**Question 5** (4 marks)

The equation for the reaction of ammonia and water is

NH3(l) + H2O(l) 🡪 NH4+(aq) + OH-(aq)

**a**. Is ammonia acting as an acid or a base in this equation? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**b**. What is the conjugate of ammonia? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**c**. What is the other conjugate pair in this equation? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**d**. Name the conjugate base of HCO3- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**Question 6** (9 marks)

**a**. The table below shows the pH range of some indicators.

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**i**. Most school laboratories keep a selection of acid base indicators. Explain how phenolphthalein might be

useful in a chemistry class. 2 marks

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**ii**. Thymol blue behaves differently to the other indicators on this table. Explain how. 1 mark

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**iii**. Lactic acid is a very weak acid. What colour will a dilute solution of lactic acid show when a few drops

of methyl orange indicator are added to it? 1 mark

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**iv.** List an indicator that could not be used to distinguish between a strong and a weak base. 1 mark

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**b**. **i**. When CO2 gas dissolves in water, it creates an acidic solution. Write an equation for the reaction,

showing the formula of the acid formed. 1 mark

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**ii**. What is calcification? 1 mark

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**iii**. How does the reduction in sea snails affect other marine organisms? 2 marks

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**END OF KEY TOPIC TEST**