

# Australian Islamic College 2018

## ATAR Chemistry Units 3 and 4

### Task 4 (Weighting: 3%)

#### Acids and Bases Test

Test Time: 40 minutes

Please do not turn this page until instructed to do so.

First Name	Surname

Teacher

Mark / 31	Percentage

Equipment allowed: Pens, pencils, erasers, whiteout, rulers and non-programmable calculators permitted by the Schools Curriculum and Standards Authority.

**Special condition:** 2 marks will be deducted for failing to write your full name on this test paper.

Teacher help: Your teacher can only help you during your test in one situation.

If you believe there is a mistake in a question show your teacher and your teacher will tell you whether or not there is a mistake in the question and if appropriate, how to fix that mistake.

Questions must be answered in this booklet, in the spaces provided.

Total marks: 31

1. Write an ionic equation and observations for the following reactions.

a. Sulfuric acid is added to solid iron(II) sulfite.

Ionic equation:

(1 mark)

Observations:

(2 marks; ½ each)

b. Ethanoic acid is added to solid copper(II) oxide.

Ionic equation:

(1 mark)

Observations:

(2 marks; ½ each)

2. Complete this table by naming each acid and classifying it as strong or weak. The first one has been done as an example.

(3 marks, 1 mark per correct row, no half marks)

<b>Formula</b>	<b>Name</b>	<b>Strong or Weak Acid</b>
<b>HNO<sub>3</sub></b>	<b>Nitric Acid</b>	<b>Strong</b>
<b>H<sub>3</sub>PO<sub>4</sub></b>		
<b>H<sub>2</sub>SO<sub>3</sub></b>		
<b>H<sub>2</sub>C<sub>2</sub>O<sub>4</sub></b>		

3. Give the formula of conjugate acid and conjugate base of the  $\text{HS}^-$  ion.  
(2 marks; 1 each)
- a. Conjugate acid
  
  
  
  
  
  
  
  
  
  
  - b. Conjugate base
4. When dissolved in water, ammonia produces a basic solution.
- a. Explain why ammonia does not fit the Arrhenius definition of a base.  
(1 mark)
  
  
  
  
  
  
  
  
  
  
  - b. Explain why ammonia does fit the Brønsted-Lowry definition of a base. State the reaction between ammonia and water to demonstrate this.  
(2 marks)
5. Pure water undergoes self-ionisation to a small extent.
- a. Write the reaction for the self-ionisation of water.  
(1 mark)
  
  
  
  
  
  
  
  
  
  
  - b. Write the equilibrium expression for  $K_w$ , the equilibrium constant for the self-ionisation of water.  
(1 mark)

c. The values of pH at two different temperatures are given below.

pH of pure water at 20°C = 7.083

pH of pure water at 100°C = 6.130

(i) Determine  $[\text{H}_3\text{O}^+]$  at 20°C.

(2 marks)

(ii) Determine the percentage ionisation of pure water at 20°C.

(3 marks)

d. Based on Le Chatelier's Principle and the information provided, is the self-ionisation of water an exothermic or endothermic process?

(1 mark)

6. List these pure substances in order of increasing pH.

(1 mark)

Substance	Ranking (1 to 7)
2 M $\text{KOH}_{(\text{aq})}$	
$\text{H}_2\text{O}_{(\text{l})}$	
2 M $\text{H}_2\text{SO}_{4(\text{aq})}$	
1 M $\text{H}_2\text{SO}_{4(\text{aq})}$	
1 M $\text{HCl}_{(\text{aq})}$	
0.5 M $\text{CH}_3\text{COOH}_{(\text{aq})}$	
0.5 M $\text{NaOH}_{(\text{aq})}$	

7. Nitrous acid is a weak acid.

- a. The pH of a 0.100 M solution of nitrous acid ( $\text{HNO}_2$ ) is 2.200.  
Determine the  $K_a$  of nitrous acid.

(2 marks)

8. Thymol blue is an acid-base indicator that is red in very acidic solution and yellow in basic solution. The  $K_a$  of thymol blue is  $2 \times 10^{-2}$ .  
Determine the pH at which thymol blue changes colour from red to yellow. Show your working.

(3 marks)

9. Some  $\text{AlCl}_3$  is dissolved in water.
- Describe the resulting solution.

(1 mark)

- Will the resulting solution be acidic, basic or neutral? Write a reaction to justify your response.

(2 marks)

END OF TEST