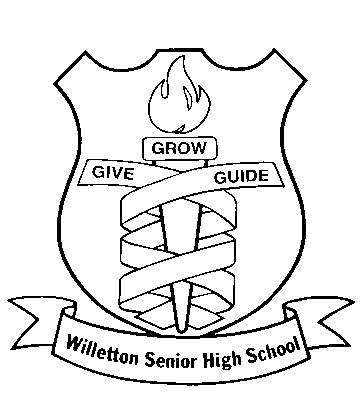
**YEAR 12 CHEMISTRY – ATCHE**

**TEST 2 2018**

**Acids & Bases**

**/ 47**

**Recommended time: 55 Minutes**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

This test is in two parts.

**Part 1:** Multiple choice style consisting of (15) questions.

Each question is worth 1 mark.

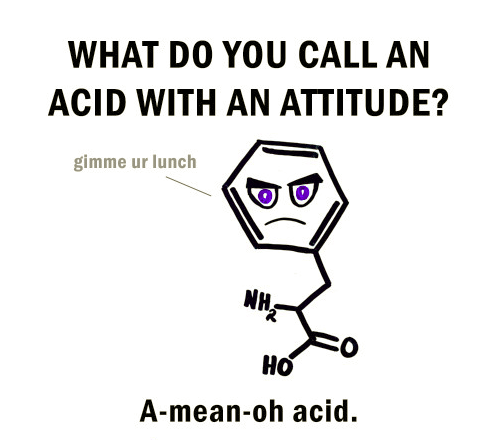
Write your answers in the table provided.

Attempt ALL Questions

**Part 2:** Short and/or Extended Answer questions worth 32 marks.

Write all answers in the spaces provided.

The marks allocated to each question are shown next to each question.



**Part 1: Multiple Choice section.**

Please write your answers in the boxes provided.

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| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
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| **11** | **12** | **13** | **14** | **15** |
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Question 1. Which of the following substances is most likely to act as a Bronstead-Lowry base?

1. Ethanol ( CH3CH2OH )
2. Ammonia ( NH3)
3. Oxygen ( O2 )
4. Hydrogen chloride ( HCl )

Question 2. When the pH of a 0.01 mol L-1 solution of sulfuric acid is measured it is found to significantly lower than the pH of a 0.01 mol L-1 solution of phosphoric acid. What is the reason for this?

1. Phosphoric acid is a triprotic acid, while sulfuric acid is only a diprotic acid, therefore the concentration of hydrogen ions is higher in the phosphoric acid solution than in the sulfuric acid solution.
2. Phosphoric acid is a stronger acid than sulfuric acid, so the phosphoric acid is more likely to produce hydrogen ions in solution than sulfuric acid.
3. Sulfuric acid is a stronger acid than phosphoric acid, so the sulfuric acid is more likely to produce hydrogen ions in solution than phosphoric acid.
4. The sulfuric acid solution is more concentrated than the phosphoric acid solution, therefore there will be more hydrogen ions in the sulfuric acid solution than the phosphoric acid solution.

Question 3. Which of the following is a reaction of an acid with a base?

1. Ag + + OH**-** ⇄ AgOH
2. HS- ⇄ H+ + S2-
3. 2Ag+ + S2- ⇄ Ag2S
4. Mg + 2H+ ⇄ Mg2+ + H2

Question 4. The hydrogen ion concentration of an acid is 1.3x 10-3 mol L-1. If the concentration of the undissociated acid is 1x 100 mol L-1, which of the following statements is true.

1. The solution is a dilute solution of a strong acid.
2. The solution is a concentrated solution of a strong acid.
3. The acid is mostly undissociated.
4. The solution is a concentrated solution of the conjugate base.

Question 5. Hydrogen sulfide and benzoic acid are both weak acids with the following acidity constants (equilibrium constants).

Ka at 25oC

hydrogen sulfide (H2S) 1.0 × 10─7

benzoic acid (C6H5COOH) 6.3 × 10─5

Two separate solutions were prepared, one of 0.1 mol L-1 hydrogen sulfide and the other of 0.1 mol L-1 benzoic acid.

Which one of the following substances would be present in the highest concentration at 25oC?

1. Benzoic acid (C6H5COOH)
2. Benzoate ion (C6H5COO**-**)
3. Hydrogen sulfide (H2S)
4. Hydrogen sulfide ion (HS**-** )

Question 6. What is the concentration of hydrogen ions in a 2.40 x 10-5 mol L-1 solution of sodium hydroxide at 25oC?

1. 2.40 x 10-9 mol L-1
2. 1.26 x 10-9
3. 4.17 x 10-10
4. 2.40 x 10-10

Question 7. What is the pH of a 0.0003 mol L-1 solution of hydroiodic acid?

1. 3
2. 3.5
3. 4
4. 4.5

Question 8. Which one of the following is the best describes the correct indicator and the reason for its use in a titration of 0.100 mol L-1 ammonia with 0.100 mol L-1 hydrochloric acid ? (Methyl red changes colour over the pH range 4.4 to 6.2, while indicator phenolphthalein changes colour over the range 8.3 to 10.0.

1. Methyl red is suitable because the solution is acidic at the equivalence point.
2. Methyl red is suitable because the solution is basic at the equivalence point.
3. Phenolphthalein is suitable because the solution is acidic at the equivalence point.
4. Phenolphthalein is suitable because the solution is basic at the equivalence point.

Question 9. The hydrolysis of the acetate ion, CH3COO**-**, produces

1. CH3COOH + OH-.
2. CH3COOH + H+.
3. CH3COOH + H2O.
4. CH3COOH + H3O+.

Question 10.

Consider the reaction:   
H2SO4 *+* H2O **⇄** HSO4- ***+*** H3O+.

Identify the two Bronsted-Lowry acids.

1. H2SO4 and H2O
2. H2SO4 and H3O+
3. H2O and H3O+
4. HSO4-and H3O+

Question 11. A scientist wishes to prepare a buffer solution at pH < 7. Which of the following combinations would be best to be used ?

1. KOH/KCl
2. HCOONa/HCOOH
3. NH3(aq)/NH4Cl
4. K2CO3/KOH

Question 12. Which of the following reasons best explains why commercial buffer solutions, used to calibrate pH meters, are usually supplied with a chart that shows their pH at various temperatures?

1. The reaction of H+ and OH- is an endothermic reaction and so occurs faster at different temperatures.
2. The colour of the buffer solution depends on the temperature at which it is observed.
3. The equilibrium constant for the acid/base pair in the buffer is changed by altering the temperature.
4. The equilibrium expression for the reaction between the acid its conjugate base changes when the temperature is altered.

Question 13. Which one of the following is the same for equal volumes of 0.100 mol L–1 solutions of ammonia and sodium hydroxide?

1. pH of the solutions at 25.0 °C
2. mass of the solute used to form each solution
3. conductivity of the solutions at 25.0 °C and standard atmospheric pressure
4. number of moles of hydrochloric acid needed for neutralisation

Question 14. The following 1.00 mol L–1 solutions are diluted to twice their original volume by the addition of water. In which solution will the pH not change but the electrical conductivity will decrease significantly?

1. sodium carbonate solution
2. ammonium chloride solution
3. sodium chloride
4. ethanoic acid

Question 15. HCO3- may, in water solution, act as either an acid or base. An equation for a reaction in which it is acting as an acid is:

1. HCO3-(aq) + CH3COOH(aq) ⇄ CO2(aq) + H2O(l) + CH3COO-(aq).
2. HCO3-(aq) + OH-(aq) ⇄ H2CO3(aq) + O2-(aq).
3. HCO3-(aq) + H3O+(aq) ⇄ CO2(g) + 2 H2O(l).
4. HCO3-(aq) + H2O(l) ⇄ CO32-(aq) + H3O+(aq).

**Part 2: Short Answer Section**

Question 16.   
(a) A buffer of carbonic acid (H2CO3)/hydrogencarbonate (HCO3**−**) is present in blood plasma to maintain a pH between 7.35 and 7.45. Write equations to show the relevant species acting as a buffer in a carbonic acid/hydrogencarbonate solution. (2 marks)

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(b) Explain why 300.0 mL of 1.00 mol L–1 carbonic acid/hydrogencarbonate buffer does not change in pH significantly when 3 drops of 1.00 mol L–1 HCℓ are added to it, yet when 3 drops of 1.00 mol L–1 HCℓ are added to 300.0 mL of distilled water there is a significant change in pH? (4 marks)

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Question 17.

Ammonium sulfate and calcium hydrogen phosphate are both salts which are added to soil. Explain, using appropriate equations, the effect of each of these on soil pH. (5 marks)

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Question 18.

Models and theories are contested and refined or replaced when new evidence challenges them. State two pieces of evidence that conflicted with the Arrhenius and Bronsted-Lowry theory of acids that led to the development of new theories. (2 marks)

Arrhenius: (i)

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| Bronsted-Lowry (ii) |
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Question 19. (11 marks)

A 20 ml solution of potassium hydroxide was standardised against a 0.040 mol L-1 solution of HCl.

1. Fill in the missing spaces in the table below and then answer the questions that follow:

STANDARDIZATION OF KOH SOLUTION:

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|  |  | 1st trial | 2nd trial | 3rd trial |
| Final reading of acid buret |  | 24.6 ml | 25.0 ml | 26.5 ml |
| Initial reading of acid buret |  | 0.0 ml | 0.5 ml | 0.0 ml |
| Total volume of acid used |  | ml | ml | ml |

(3 marks)

1. What is the molarity (concentration) of the base?. (Show all working for full marks) (3 marks)

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1. What volume of the solution of KOH from part b) would be required to neutralise 20.0mL of a 0.150 mol L-1 solution of the triprotic acid citric acid? (Show all working for full marks) (3 marks)

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1. From your answer to part (c), would you expect the final pH to be acidic, neutral, or basic? Give a reason for your answer. (2 marks)

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1. Name a suitable indicator for this titration of KOH and citric acid. (1 mark)

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Question 20. The rivers upon which Perth and its surroundings are located are called the Swan and Canning rivers. Their combined volume is approximately 160 gigalitres. In winter, the average pH is 7.9.

1. Theoretically, how many 100 litre drums of 10 mol L-1 sodium hydroxide would it take to raise that volume of water to that pH? (show all working for full marks) (4 marks)

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1. In reality, it would probably take more sodium hydroxide than the amount you just calculated. State the most likely reason why this is so. Explain your answer using any relevant equations. (3 marks)

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END OF TEST