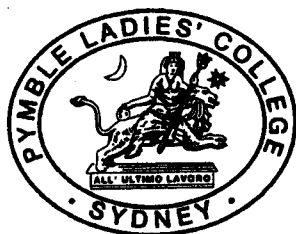


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*Pymble Ladies' College*

# Chemistry

**2002**

**Trial Examination**

## General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Board-approved calculators may be used
- Write using black or blue pen
- Draw diagrams using pencil

## Section I

Total marks (71)

This section has two parts, Part A and Part B

**Part A** Multiple choice Total marks (15)

- Attempt Questions 1–15
- Allow about 30 minutes for this part

**Part B** Extended Answers Total marks (56)

- Attempt Questions 16–27
- Allow about 1 hour and 35 minutes for this part

## Section II

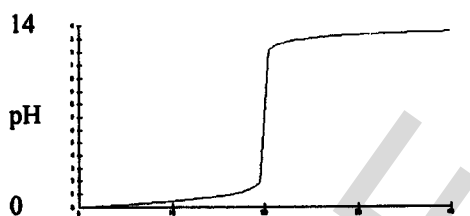
Total marks (29)

- Attempt ONE question - Question 28
- Allow about 55 minutes for this section

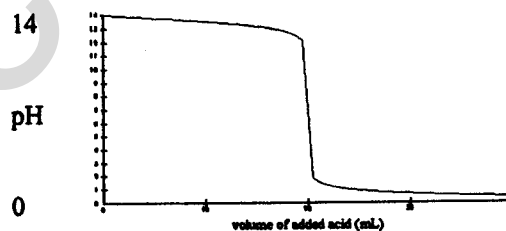
**Section I – Part A**

1. Which of the following would be the best method to obtain a standard solution of hydrochloric acid?
- Weigh out 3.65 g of concentrated hydrochloric acid and dissolve this in 1 litre of distilled water.
  - Measure exactly 3.65 mL of concentrated hydrochloric acid and make it up to 1 litre with distilled water.
  - Titrate any hydrochloric acid solution against a base solution whose concentration is known accurately.
  - Dissolve a known volume of hydrogen chloride in a known volume of water.
2. What is the pH of a solution made by diluting 10 mL of a hydrochloric acid solution with pH of 1 to 100mL?
- 0
  - 1
  - 2
  - 13
3. A pH meter is used to measure the pH of 100mL of a 1.0M solution of a strong base to which a 1.0M solution of a strong acid is added. Which of the following graphs represents this process?

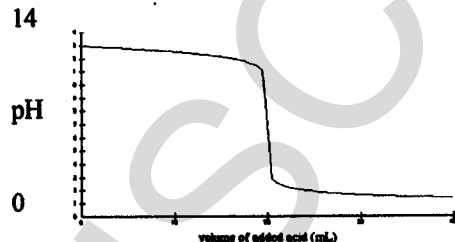
A



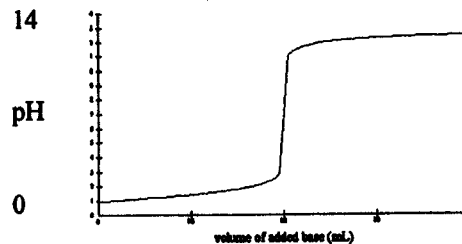
B



C



D



4. Which of the following has the lowest pH?
- 0.5 M NaOH
  - 0.1 M KOH
  - 0.1 M HCl
  - 0.5 M HNO<sub>3</sub>

5. In which list do all species act as Bronsted-Lowry acids?

- A.  $\text{NH}_2^-$ ,  $\text{H}_2\text{O}$ ,  $\text{NO}_3^-$
- B.  $\text{H}_2\text{O}$ ,  $\text{HCO}_3^-$ ,  $\text{HPO}_4^-$
- C.  $\text{H}_2\text{PO}_4^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{OH}^-$
- D.  $\text{NO}_2^-$ ,  $\text{OH}^-$ ,  $\text{CH}_3\text{COO}^-$

6. The compound below which would not be a suitable monomer for making an addition polymer is

- A.  $\text{CH}_2=\text{CH}-\text{CN}$
- B.  $\text{CF}_2=\text{CF}_2$
- C.  $\text{CHCl}=\text{CHCl}$
- D.  $\text{HOOC}-\text{CH}_2-\text{CH}_2\text{NH}_2$

7. Identify the product formed when 2-hexene is mixed with Bromine

- A. bromohexane
- B. 2-bromohexane
- C. 2,3-dibromohexane
- D. 2,2-dibromohexane

8. Consider the following reaction



The oxidant and the reductant in the above reaction respectively are

- A.  $\text{I}^-$  and  $\text{IO}_3^-$
- B.  $\text{H}^+$  and  $\text{I}^-$
- C.  $\text{IO}_3^-$  and  $\text{I}^-$
- D.  $\text{I}_2$  and  $\text{IO}_3^-$

9. In the following nuclear equation



- A.  $z=218$  and  $y=88$
- B.  $z=218$  and  $y=84$
- C.  $z=226$  and  $y=84$
- D.  $z=226$  and  $y=86$

10. PVC is an example of an addition polymer. The common name and the systematic name for the monomer from which this polymer is formed are

- A. polyvinyl chloride and chloroethane
- B. vinyl chloride and chloroethene
- C. vinyl chloride and 1,2-dichloroethene
- D. vinyl chloride and 2-dichloroethane

11. Which of the following gives the major use of ammonia?
- A. the synthesis of cleaning solutions
  - B. the synthesis of explosives
  - C. the manufacture of nylon and acrylonitrile
  - D. the synthesis of fertilisers
12. The catalyst used in the Haber process is:
- A. Osmium
  - B. Activated Iron
  - C. Zeolite
  - D. Concentrated sulfuric acid
13. You have been given a solution believed to contain barium ions ( $\text{Ba}^{2+}$ ). Which of the following tests would be the most useful in identifying this cation?
- A. Addition of sodium carbonate solution,  $\text{Na}_2\text{CO}_3$
  - B. Addition of sodium chloride solution,  $\text{NaCl}$
  - C. Performing a flame test
  - D. Addition of nitric acid,  $\text{HNO}_3$
14. During the tests for biochemical oxygen demand (BOD), a sample of water is kept in the dark for five days before being tested for its dissolved oxygen level.
- What is the purpose of keeping the sample in the dark?
- A. To prevent photosynthesis occurring and adding oxygen to the water
  - B. To prevent photosynthesis occurring and removing oxygen from the water
  - C. To prevent respiration occurring and adding oxygen to the water
  - D. To prevent respiration occurring and removing oxygen from the water
15. You have been given a solution of  $\text{CuSO}_4$  and a solution of  $\text{FeSO}_4$ . Which of the following tests would be the most useful in distinguishing between the two solutions?
- A. Addition of silver nitrate solution,  $\text{AgNO}_3$
  - B. Addition of barium nitrate solution,  $\text{Ba}(\text{NO}_3)_2$
  - C. Addition of ammonium hydroxide,  $\text{NH}_4\text{OH}$
  - D. Addition of potassium iodide,  $\text{KI}$

**Section I – Part B****Total marks (56)****Attempt questions 16 – 27****Allow about 1 hour and 35 minutes for this part**

Answer the questions in the spaces provided

**Question 16 (2 marks)**

Sodium cyanide NaCN gives a basic solution when dissolved in water. This is due to the hydrolysis of the salt.

a) Use a chemical equation to show why this solution is basic.

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1

b) Write the formula of the conjugate acid of the cyanide ion.

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1

**Question 17 (5 marks)**

a) Calculate the volume of 6M hydrochloric acid (HCl) which would be needed to neutralise a spill of 1 kg of sodium hydroxide (NaOH) pellets.

2

b) Assess the use of 6M acid to neutralise the sodium hydroxide spill.

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3

**Question 18 (6 marks)**

a) An esterification reaction is carried out using propanol and ethanoic acid. Name the ester formed in the reaction.

\_\_\_\_\_

1

b) Explain why refluxing is necessary to produce an ester.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2

c) After refluxing, it is necessary to purify an ester by distillation. If the reactants were ethanoic acid and ethanol, identify which of these impurities would boil at a lower temperature and distil off first. Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3

**Question 19 (5 marks)**

A student was asked to determine the Heat of Neutralisation of a 1.0 M solution of nitric acid with a 1.0 M solution of potassium hydroxide.

a) Outline the procedure used to do this experiment.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2

- b) Calculate the Heat of Neutralisation for this reaction, if the following data was obtained when 100mL of both the acid and the base are used.  
 Initial temperature of the base and acid = 17.0°C  
 Final temperature of reaction mixture = 22.9°C  
 Specific Heat capacity of water = 4.2 JK<sup>-1</sup>g<sup>-1</sup>

2

- c) The theoretical value for neutralisation of a strong acid with a strong base is 55kJ mol<sup>-1</sup>. Identify the main error which may have occurred in this experiment to explain the difference in the experimental result.

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1

**Question 20 (4 marks)**

Water collected from a lake located near an industrial town was found to be acidic. The air in this area is polluted with sulfur dioxide.

- a) Identify a possible source of the air pollutant.

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1

- b) Explain the acidity of the lake water using equations.

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1

- c) Evaluate reasons for concern about the release of oxides of sulfur and nitrogen into the environment.

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2

**Question 21. (8 marks)**

Modern cars run on petrol. One common ingredient in this petrol is 3,4-dimethyl-1-pentene. Ethanol is currently being used to supplement the use of petrol in cars. Ethanol is produced by the fermentation of sugars. It is thus classed as a renewable resource.

a) Draw a structural formula for 3,4-dimethyl-1-pentene

1

b) Identify the conditions under which ethanol is produced from the fermentation of glucose.

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2

c) Assess the potential of ethanol as an alternative fuel by discussing the advantages and disadvantages of its use.

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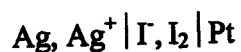
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5



**Question 22 (7 marks)**

The shorthand diagram for a particular galvanic cell is



a) Outline the construction of the galvanic cell above by drawing a fully labelled diagram

4

b) Identify the direction of electron flow

1

c) Describe what is happening in this cell in terms of oxidation and reduction

2

**Question 23 (4 marks)**

a) Identify one radioisotope used in medicine.

1

b) Describe how this radioisotope is used

2

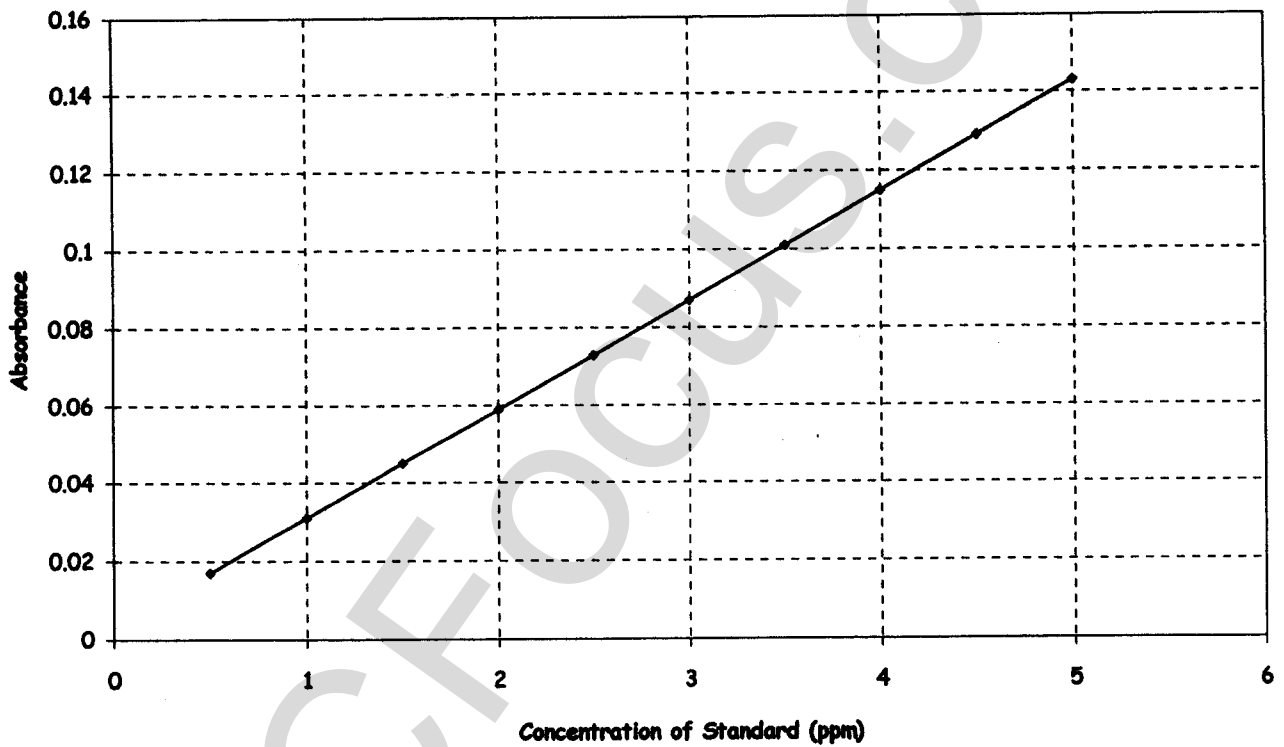
c) Relate this to the chemical properties of the radioisotope.

1

**Question 24 (2 Marks)**

AAS has been used to determine the concentration of cadmium ions in oysters that are being bred near an industrial waste outlet. The absorbance reading of the sample taken from the oysters was 0.075.

HEAVY METAL	LIMIT (ppm wet weight)
Mercury	0.4
Cadmium	2.1
Lead	2.3
Copper	3.1
Zinc	900



(a) Use the data above to determine the concentration of cadmium ions in the oysters.

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1

(b) Deduce whether the levels are cause for concern for seafood eaters.

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1



4

**Question 27 (3 Marks)**

Water is purified and sanitised before it is supplied to residents for domestic use.

Assess the effectiveness of the addition of chlorine to water during its treatment for supply to townships and cities.

3

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**Section II****OPTION 2 SHIPWRECKS AND SALVAGE****Question 28**

Allow about 55 minutes for this section.

Total marks (29)

Answer the question on writing paper. Extra writing paper is available.

a) Seawater contains an average of 35g of dissolved solids per kilogram of water. It also contains dissolved gases.

i) Identify the major sources of these salts in seawater. 2

ii) Outline the factors that affect the solubility of carbon dioxide in seawater. 3

b) Explain in terms of oxidation and reduction each of the following:

i) Zinc is a more useful coating for protecting iron nails than copper. 2

ii) Rusting of steel bridges near the ocean occurs more readily than those inland over dry creek beds. 2

iii) Aluminium is known as a passivating metal. 1

c) Compare the composition, properties and uses of the two steels below:

Type of steel	Element alloying with iron.	Uses
tungsten	12-20% W 2-5% Cr 1-3% V	High speed cutting tools
silicon	2-5% Si	electromagnets, transformers

3

d) Compare an electrolytic and a galvanic cell giving an example of each.

4

e) A shipwreck "A" lies in the harbour at Broome in WA. Each day the tide recedes, exposing the whole ship to the atmosphere for several hours until the tide returns and submerges the wreck again. A second shipwreck "B" lies at a depth of 2000 metres in the Antarctic. Compare the corrosion that will occur in these two shipwrecks "A" and "B".

6

6

f) Salvaging artifacts from shipwrecks can be a costly and time-consuming process.

With particular reference to metallic objects, outline the processes that could be used to restore these artefacts to their near-original state.