VCE CHEMISTRY 2016

YEAR 11 **TRIAL** EXAM

Unit 2
Reading time: 15 minutes
Writing time: 90 minutes

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	20	20	20
B	8	8	50
			Total 70

To download the Chemistry Data Book please visit the VCAA website:
http://www.vcaa.vic.edu.au/Documents/exams/chemistry/chemdata-w.pdf

Learning Materials *by Lisachem*
PO Box 2018, Hampton East, Victoria, 3188
Ph: (03) 9598 4564 Fax: (03) 8677 1725
Email: orders@learningmaterials.com.au or orders@lisachem.com.au
Website: www.learningmaterials.com.au

STUDENT NUMBER

									Letter
Figures									
Words									

Student Name....…….....

VCE Chemistry 2016 Year 11 Trial Exam Unit 2

Student Answer Sheet

Instructions for completing test. Use only a 2B pencil. If you make a mistake, erase it and enter the correct answer. Marks will not be deducted for incorrect answers.

Write your answers to the Short Answer Section in the space provided directly below the question. There are **20 Multiple Choice** questions to be answered by circling the correct letter in the table below.

Question 1	A	B	C	D	*Question 2*	A	B	C	D
Question 3	A	B	C	D	*Question 4*	A	B	C	D
Question 5	A	B	C	D	*Question 6*	A	B	C	D
Question 7	A	B	C	D	*Question 8*	A	B	C	D
Question 9	A	B	C	D	*Question 10*	A	B	C	D
Question 11	A	B	C	D	*Question 12*	A	B	C	D
Question 13	A	B	C	D	*Question 14*	A	B	C	D
Question 15	A	B	C	D	*Question 16*	A	B	C	D
Question 17	A	B	C	D	*Question 18*	A	B	C	D
Question 19	A	B	C	D	*Question 20*	A	B	C	D

VCE Chemistry 2016 Year 11 Trial Exam Unit 2

SECTION A – Multiple Choice Questions

(20 marks)

This section contains 20 multiple choice questions.
For each question, choose the response that is correct or best answers the question.
Indicate your answer on the answer sheet provided.
*(Choose only **one** answer for each question.)*

Question 1
The amount of energy, in kJ, required to raise the temperature of 5.00 L of water from 25.0 °C to 95.0 °C would be
A. 1.46 kJ
B. 1.99 kJ
C. 1460 kJ
D. 1990 kJ

Question 2
The boiling point for hydrogen sulfide, H_2S, is -60 °C. The reason why this Group 16 hydride has a boiling point significantly different to water is that
A. the hydrogen-sulfur bonds in H_2S are more polar than the hydrogen-oxygen bonds in water.
B. the bonding interactions between the water molecules are stronger than those between the hydrogen sulfide molecules.
C. hydrogen sulfide molecules have a heavier mass, therefore require more energy to change into a gas.
D. the bonding interactions within the water molecules are stronger than those within the hydrogen sulfide molecules.

Question 3
A precipitate will be formed when aqueous solutions of
A. sodium chloride and zinc nitrate are mixed.
B. copper(II) nitrate and manganese(II) chloride are mixed.
C. cobalt(II) chloride and silver nitrate are mixed.
D. potassium chloride and barium nitrate are mixed.

Question 4
The pH of a 100.0 mL sample of aqueous 0.0100 M sodium hydroxide would be
A. 2
B. 3
C. 11
D. 12

Question 5
The reaction that occurs when aqueous 0.5 M sulfuric acid solution is added to some solid copper(II) oxide can best be described by the ionic equation

A. $CuO(s) + H^+(aq) \rightarrow CuOH^+(aq)$

B. $CuO(s) + H_2SO_4(aq) \rightarrow CuSO_4(s) + H_2O(l)$

C. $CuO(s) + 2H^+(aq) \rightarrow Cu^{2+}(aq) + H_2O(l)$

D. $O^{2-}(s) + 2H^+(aq) \rightarrow H_2O(l)$

Question 6
In a reduction-oxidation, redox, reaction, the oxidant

A. donates electrons and is reduced.
B. accepts electrons and is reduced.
C. accepts electrons and is oxidised.
D. donates electrons and is oxidised.

Question 7
The conjugate base for the hydrogen carbonate ion, $HCO_3^-(aq)$, is

A. $OH^-(aq)$
B. $H_2CO_3(aq)$
C. $CO_3^{2-}(aq)$
D. $H_2CO_4^{2-}(aq)$

Question 8
In which one of the following lists will **all** of the compounds be soluble in water?

A. NaCl, CH_3OH, CH_3COOH, C_6H_6
B. C_2H_5OH, KCl, HCOOH, HCl
C. CH_4, C_8H_{18}, CH_3OH, CCl_4
D. HCl, $CaCl_2$, C_6H_{14}, NH_3

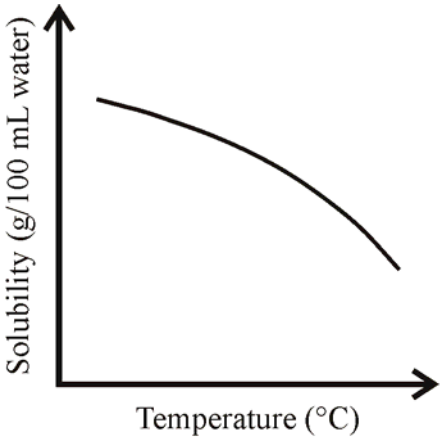
Question 9
The reaction between dilute hydrochloric acid and magnesium metal can be described by the ionic equation

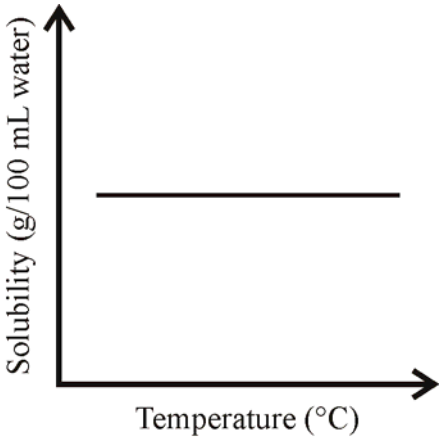
$$Mg(s) + 2H^+(aq) \rightarrow Mg^{2+}(aq) + H_2(g)$$

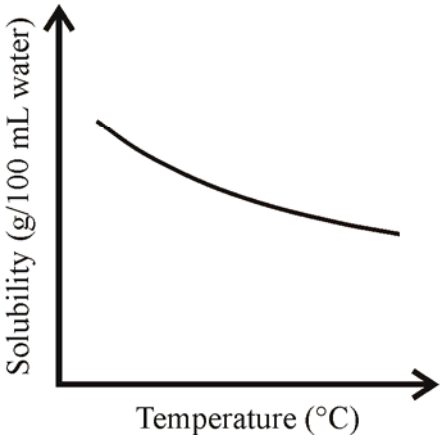
In this reaction, the H^+ ions are acting as

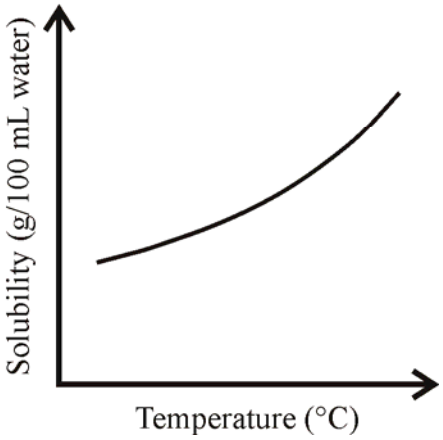
A. an oxidant.
B. an acid.
C. a reductant.
D. a base.

Question 10
A group of VCE students were investigating the solubility of sugar between 10 °C and 90 °C. When they plotted their data, which of the following graphs would their solubility curve most likely resemble?

A.


B.


C.


D.


Question 11
Historical records revealed that mercury based materials were used to extract gold and may have entered the waterway of an old gold mining area. The most suitable method that an environmental chemist could use to determine the levels of mercury in the local creek water would be a technique that used

A. high performance liquid chromatography.
B. volumetric analysis.
C. atomic absorption spectrophotometry.
D. gravimetric analysis.

Question 12
A student placed 10.0 mL of an aqueous 0.10 M sodium sulfate solution in a flask and diluted this to 250.0 mL with deionised water. When mixed, the sulfate ion concentration of the solution would be

A. 0.0040 M
B. 0.0080 M
C. 0.040 M
D. 0.080 M

Question 13
The label on a domestic cleaning product stated that it contained 17 % NH_4OH (m/v). What would be the numerical value for the concentration of NH_4OH in mol L^{-1}?

A. 0.0049
B. 0.049
C. 0.49
D. 4.9

Question 14
The data that a student collected in an experiment to determine the amount of dissolved salts in a sample of sea water are shown below.

Mass of empty evaporating basin	35.094 g
Mass of evaporating basin plus sea water	137.594 g
Mass of evaporating basin plus solid – first weighing	39.039 g
Mass of evaporating basin plus solid – second weighing	38.274 g
Mass of evaporating basin plus solid – third weighing	38.274 g

What was the percentage by mass (% m/m) of the dissolved salts in this sample of sea water?

A. 9.06 %
B. 3.85 %
C. 3.10 %
D. 2.31 %

Question 15
The reaction between dilute aqueous solutions of sulfuric acid and sodium hydrogen carbonate can be represented by the chemical equation

$$H_2SO_4(aq) + 2NaHCO_3(aq) \rightarrow Na_2SO_4(aq) + 2CO_2(g) + 2H_2O(l)$$

What would be the volume of 0.1200 M aqueous sulfuric acid required to neutralise 20.00 mL of 0.1350 M aqueous sodium hydrogen carbonate solution?

A. 8.89 mL
B. 11.25 mL
C. 17.78 mL
D. 22.25 mL

Question 16
With reference to monoprotic acids, compared to the pH of a strong acid, the pH of an aqueous solution of a weak acid with the same concentration will be

A. lower.
B. the same.
C. double.
D. higher.

Question 17
Which one of the following chemical equations does **not** describe a redox reaction?

A. $Zn(s) + 2H^+(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$

B. $Fe^{2+}(aq) + 2OH^-(aq) \rightarrow Fe(OH)_2(s)$

C. $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

D. $Cu(s) + Cl_2(g) \rightarrow CuCl_2(s)$

Question 18
Cloudy ammonia is a domestic cleaning product produced by dissolving ammonia gas, NH_3, in water. If a sample is left in an open beaker, kept at constant temperature, the concentration of ammonia in the solution will

A. decrease.
B. increase as the water evaporates.
C. remain the same.
D. decrease as the water evaporates.

Question 19
What mass of sodium sulfate would be needed to prepare 5.00 L of an aqueous solution that has a sodium ion concentration of 0.025 M?

A. 1.776 g
B. 3.553 g
C. 8.881 g
D. 17.76 g

Question 20
The two main ions that contribute to the eutrophication of a water source are

A. phosphate and nitrate ions.
B. lead and nitrate ions.
C. lead and mercury ions.
D. sodium and phosphate ions.

End of Section A

VCE Chemistry 2016 Year 11 Trial Exam Unit 2

SECTION B – Short Answer Questions

(50 marks)

This section contains eight questions, numbered 1 to 8.
All questions should be answered in the spaces provided.
The mark allocation for each question is given.

Question 1 (4 marks)

a. Write appropriate chemical equations to describe the reactions that would occur when the following pairs of aqueous solutions are mixed.

i. Iron(III) sulfate and sodium hydroxide. **1 mark**

ii. Nickel(II) sulfate and barium nitrate. **1 mark**

b. The latent heat of vaporisation is the amount of energy required to change a specific amount of the material from its liquid state to the gaseous state at the boiling point of the material. Methane and water are compounds with similar molecular masses. The latent heat of vaporisation of methane and water are 8.6 kJ mol^{-1} and 40.7 kJ mol^{-1} respectively.

i. Explain why there is such a significant difference between these two values considering that both molecules have similar molecular masses. **1 mark**

ii. What implication does this have with regards to the storage of these two materials at temperatures near their boiling points? **1 mark**

Question 2 (8 marks)

a. The hydrogen sulfite ion, HSO_3^-, is amphiprotic.

i. Using the Brønsted-Lowry theory of acids and bases, explain the meaning of the term amphiprotic. **1 mark**

ii. Write appropriate chemical equations that would demonstrate this property for this ion. **2 marks**

b. Explain the difference between a strong acid and a concentrated acid. **2 marks**

c. Calculate the concentrations of the $H_3O^+(aq)$ and $OH^-(aq)$ ions in an aquarium that has a pH of 7.5 at 25 ºC. **2 marks**

d. Write an appropriate chemical equation to describe the reaction that would occur when a dilute aqueous solution of nitric acid, $HNO_3(aq)$, is added to some solid marble chips, $CaCO_3$. **1 mark**

Question 3 (9 marks)

a. Students were investigating the redox properties of three metals, X, Y and Z. They placed small pieces of the metal in aqueous solutions of the metal ions, $X^{2+}(aq)$, $Y^{+}(aq)$ and $Z^{2+}(aq)$. They tabulated their observations, using a tick to show if a reaction occurred, as shown below.

		Metal ion solutions		
		$X^{2+}(aq)$	$Y^{+}(aq)$	$Z^{2+}(aq)$
Metal	X	-	✓	✓
	Y	×	-	×
	Z	×	✓	-

i. Use the students' tabulated data to determine the strongest oxidant and strongest reductant. **2 marks**

ii. Write the appropriate chemical half-equation for the oxidation and reduction half-reactions that occur when metal Z is added to an aqueous solution of $Y^{+}(aq)$. **2 marks**

iii. Write the overall chemical equation for the reaction that occurs when metal Z is added to an aqueous solution of $Y^{+}(aq)$. **1 mark**

b. Corrosion of metals, especially iron based materials, is a significant burden on society.

i. Steel cans used for foods are plated with a thin coating of tin. Explain how this method protects the steel. **1 mark**

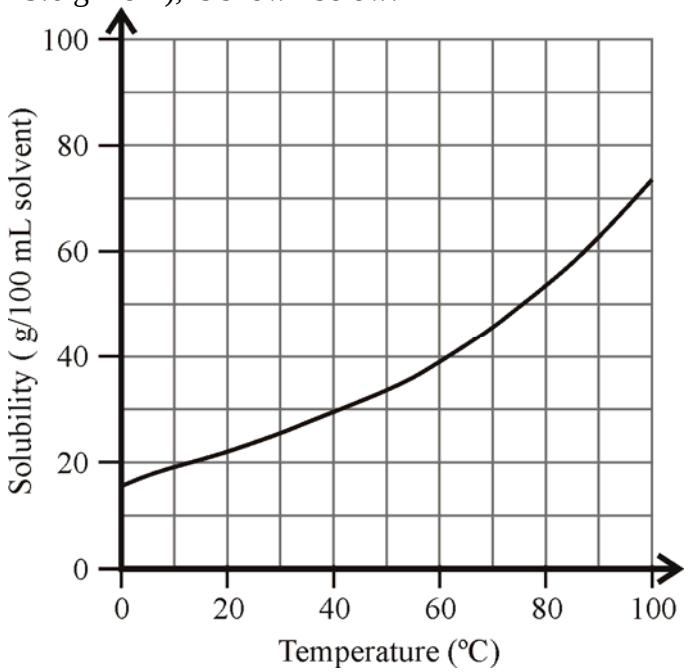
ii. What will happen to the steel if the tin surface is scratched away in a small area on the can? **1 mark**

iii. Roofing steel sheets are coated with a thin coating of zinc. Explain how this protects the steel. **1 mark**

iv. What would be the main reason that zinc is not used as a coating on food cans? **1 mark**

Question 4 (5 marks)

The experimental determined solubility curve for copper(II) sulfate pentahydrate, $CuSO_4 \cdot 5H_2O$ (M = 249.6 g mol^{-1}), is shown below.



a. A group of students placed 10.0 g of solid copper(II) sulfate pentahydrate in a test tube and added 20.0 mL of deionised water. Determine the temperature that they would have to heat the mixture to in order to form a saturated solution. **1 mark**

b. What mass of solid should crystallise when 250.0 mL of a saturated solution at 90 ºC is cooled to 20 ºC? **2 marks**

c. A chemist calculated that they required a 3.0 M aqueous solution for an experiment that they were planning to conduct. Explain, using the solubility data, if this solution could be prepared or not. **2 marks**

Question 5 (6 marks)

In an experimental investigation designed to measure the amount of dissolved salts present in samples of creek water, students followed the following method to measure the electrical conductivity of water samples.

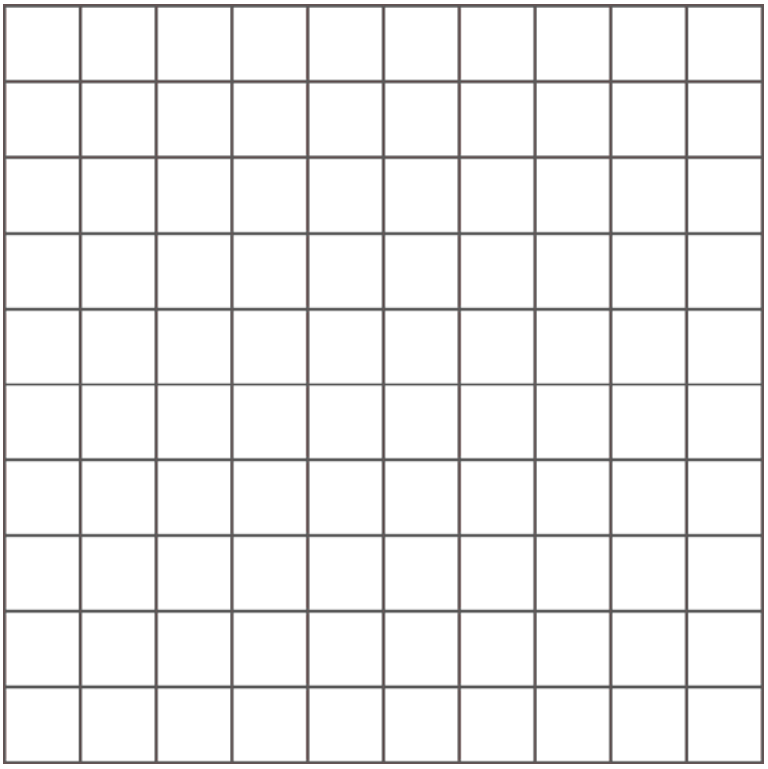
All glassware used in the experiment was thoroughly rinsed with deionised water.

A stock solution of sodium chloride was prepared and this was diluted to prepare a set of calibration solutions.

The electrical conductivity of these solutions and a sample of creek water were measured using the same conditions and meter. The data collected are shown below.

NaCl Concentration ($g\ L^{-1}$)	**Electrical Conductivity (units)**
Deionised water	20
1.0	1712
2.0	3295
3.0	5002
4.0	6583
5.0	8217
Water sample	3676

a. On the grid below, draw a calibration curve for the electrical conductivity of the aqueous sodium chloride solutions. **3 marks**



b. Use the data to determine the equivalent amount of sodium chloride that would correspond to the amount of dissolved salts in the water sample. **1 mark**

c. Explain why all of the glassware used in the experiment was thoroughly rinsed with deionised water prior to commencing the experiment. **1 mark**

d. What could be one possible cause for this level of dissolved salts in the creek water analysed by the students? **1 mark**

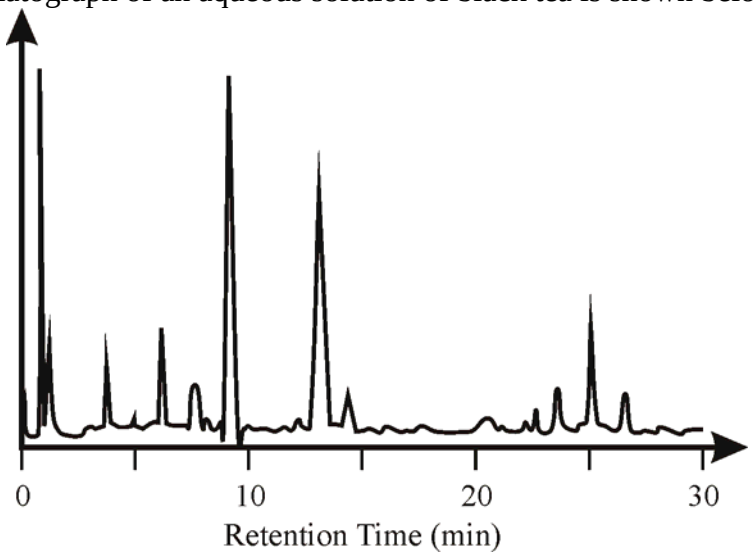
Question 6 (6 marks)

a. Organic contaminants of water supplies can pose a significant environmental problem.

i. What could be two materials that could be the sources of organic contaminants in water supplies? **2 marks**

ii. Explain the potential environmental impact of one of the materials that led to the organic contaminants given in i. above. **1 mark**

b. A technique for determining organic material (either contaminant or naturally occurring) in water samples or aqueous solutions, is high performance liquid chromatography, hplc.
The chromatograph of an aqueous solution of black tea is shown below.



i. How would it be possible to identify which of the peaks in the chromatogram is due to caffeine? **1 mark**

ii. Explain how a chemist could use the chromatogram to determine the amount of caffeine in the sample once the peak due to caffeine had been identified. **2 marks**

Question 7 (7 marks)

As part of a VCE Chemistry investigation, a group of students aimed to determine the amount of ethanoic acid in vinegar.

The reaction between aqueous solutions of ethanoic acid and sodium carbonate can be described by the chemical equation

$$2CH_3COOH(aq) + Na_2CO_3(aq) \rightarrow 2NaCH_3COO(aq) + CO_2(g) + H_2O(l)$$

The students diluted a 20.00 mL sample of vinegar with deionised water so that the total volume of the solution was 250.0 mL. 10.00 mL aliquots of aqueous 0.100 M sodium carbonate solution were titrated with the diluted vinegar solution. The average titre required was 11.50 mL.

a. Determine the amount of sodium carbonate in the aliquot. **1 mark**

b. Determine the amount of ethanoic acid that reacted with the sodium carbonate. **1 mark**

c. Determine the concentration of ethanoic acid in the diluted vinegar solution. **1 mark**

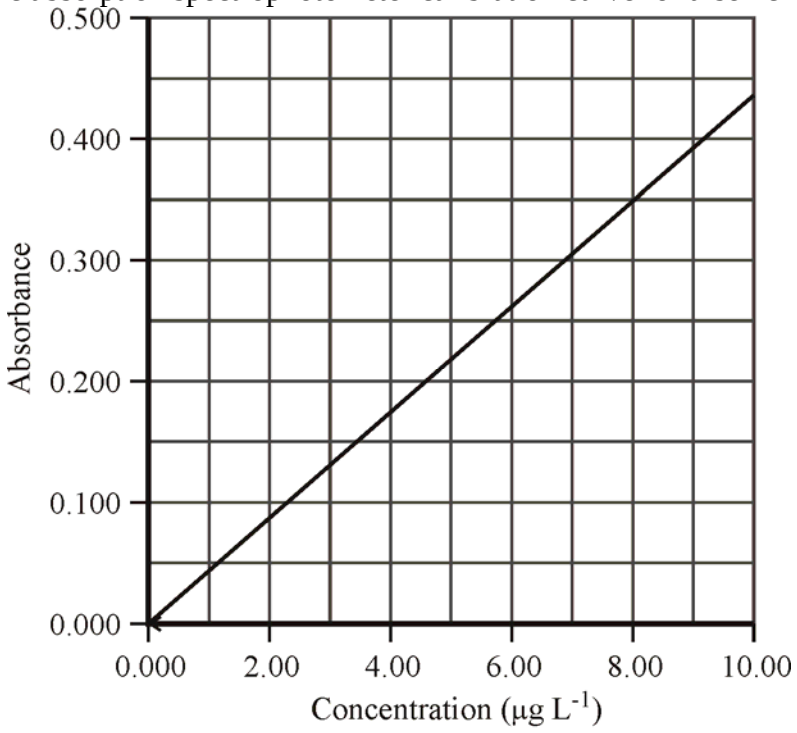
d. Determine the concentration of ethanoic acid in the original vinegar. **1 mark**

e. Express this concentration as a percentage mass per volume, % (m/v), and compare it with the manufacturer's claim that the vinegar contains 12.5 % (m/v) of ethanoic acid. **3 marks**

Question 8 (5 marks)

a. The label on a brick cleaning product stated that it contained 22 % (m/m) HCl.
Students found that 100.0 mL of this solution had a mass of 110.8 g.
Determine the concentration of the hydrochloric acid in mol L^{-1}. **2 marks**

b. Arsenic contamination of water supplies is a major problem in some developing countries.
An atomic absorption spectrophotometer calibration curve for arsenic is shown below.



When a sample of well water was analysed using this spectrophotometer, an absorption of 0.273 was obtained.

i. Determine the concentration of arsenic in the well water. **1 mark**

ii. The World Health Organisation, WHO, states that the maximum safe level for arsenic in water for domestic use, is 10 ppb.
Determine if this water sample would meet the WHO safe level. **1 mark**
($1\ \mu g = 1.0\times10^{-6}$ g, assume 1.0 L water has a mass 1.0 kg)

iii. Explain how the use of this water supply could pose a problem when used to irrigate crops. **1 mark**

End of Section B

End of Trial Exam