

Section A: Multiple Choice (1 mark each)

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9
A B C D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

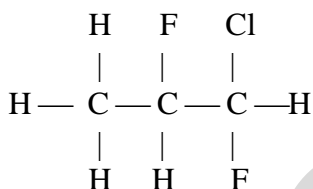
A B C D
An arrow labeled "correct" points to option B.

Write your answer on the response grid on page 2

1. Which statement is correct concerning the use of a catalyst in the Haber Process?

- (A) A catalyst enables a lower reaction temperature to be used.
- (B) A catalyst produces ammonia of greater purity.
- (C) A catalyst speeds up the forward reaction and slows down the reverse reaction.
- (D) A catalyst removes ammonia from the product mixture allowing the equilibrium to shift to the right.

2. What is the name of the compound below?



- (A) 1-chloro-1,2-difluoropropane
- (B) 3-chloro-2,3-difluoropropane
- (C) 1,2-difluoro-1-chloropropane
- (D) 1-chloro-1,2-fluoropropane

3. If Professor Le Châtelier visited an ammonia factory which combination of variables would he advise to maximise production?

- (A) low pressure and low temperature
- (B) low pressure and high temperature
- (C) high pressure and low temperature
- (D) high pressure and high temperature

4. *Sydney Water* tests a sample of water at Warragamba Dam. The results are shown in the table...

<i>Aluminium</i> ($\mu\text{g L}^{-1}$)	<i>Total chlorine</i> (mg L^{-1})	<i>Fluoride</i> (mg L^{-1})	<i>Iron</i> ($\mu\text{g L}^{-1}$)	<i>Manganese</i> ($\mu\text{g L}^{-1}$)
< 10	1.52	1.11	< 20	6

Which chemical species could be efficiently assayed using AAS?

- (A) Total chlorine
- (B) Total chlorine and fluoride
- (C) Aluminium, iron and manganese
- (D) Aluminium, total chlorine, fluoride, iron and manganese

5. What is the purpose of adding chlorine to domestic water supplies?

- (A) To reduce the pH of the water
- (B) To remove the heavy metal ions like lead from the water.
- (C) To clarify the water
- (D) To disinfect the water

6. In which layer of the atmosphere does ozone act as a UV radiation shield?

- (A) mesosphere
- (B) stratosphere
- (C) thermosphere
- (D) troposphere

Section A

Multiple Choice

Answer Grid

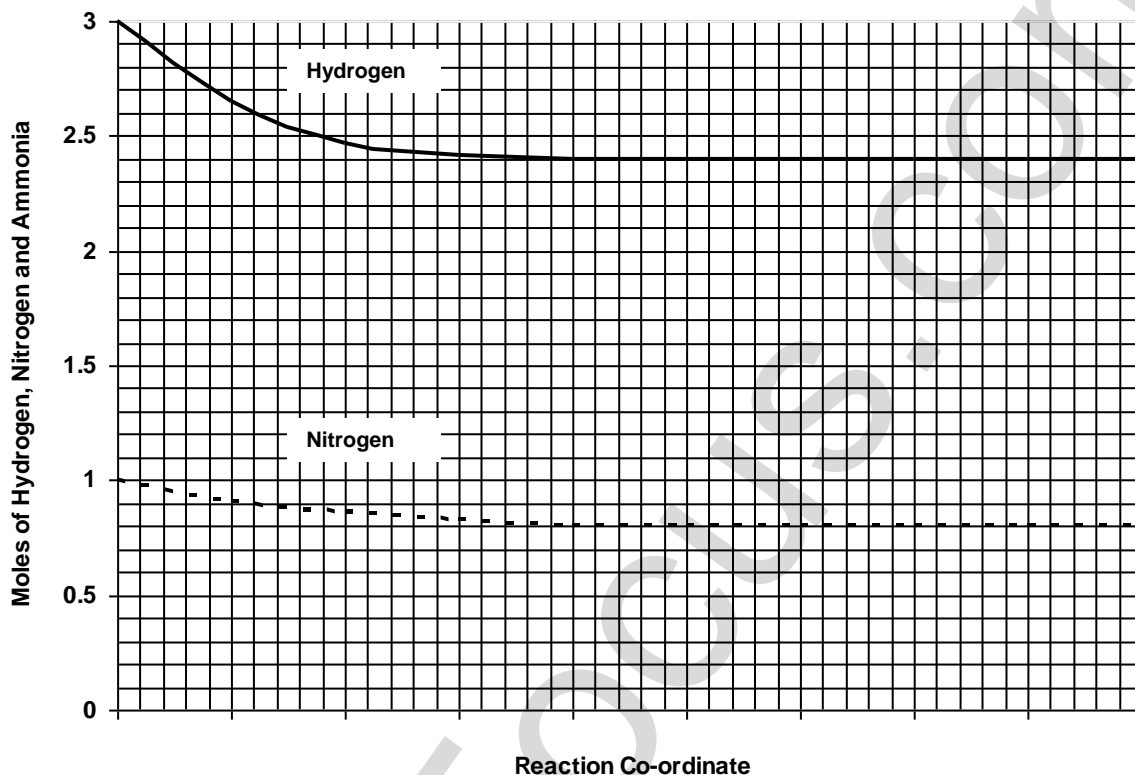
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|----|-----|-----|-----|-----|
| 1. | A O | B O | C O | D O |
| 2. | A O | B O | C O | D O |
| 3. | A O | B O | C O | D O |
| 4. | A O | B O | C O | D O |
| 5. | A O | B O | C O | D O |
| 6. | A O | B O | C O | D O |

Section B: Short Answer Questions

Question 7 (6 marks)

The Syntex Ammonia Corporation produces ammonia via the Haber process by mixing hydrogen and nitrogen in a 3:1 mole ratio and passing it over a promoted iron catalyst at 500°C and 200 atm. Under these conditions the yield of ammonia is 20%.

The graph shows a pair of lines for the reaction of hydrogen and nitrogen during the synthesis of ammonia...



- (a) Draw in a line showing the simultaneous production of ammonia during this process. (1 mark)
- (b) Explain the effects of temperature on the production of ammonia. (4 marks)

- (c) In 1918 Fritz Haber was awarded the Nobel Prize for his ammonia process.
Why was this discovery so significant to warrant a Nobel Prize?

(1 mark)

Question 7 (4 marks)

Mount Ruse[®] Mineral Water is analysed for the presence of iron, chloride and carbonate ions.

- (a) Complete the table showing suitable test reagents and results... **(3 marks)**

<i>Ion tested</i>	<i>Test reagent used (name <u>or</u> formula)</i>	<i>Observed result for a positive test</i>
iron		
chloride		
carbonate		

- (b) *Mount Ruse*[®] Mineral Water is also known to contain calcium ions.

Describe a simple test to detect calcium which does not involve a test reagent. **(1 mark)**

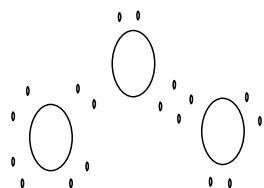
Question 8 (4 marks)

- (a) Describe what is meant by a coordinate covalent bond.

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- (b) Circle the covalent bond in the diagram of ozone.



- (c) Identify the type of diagram used in question (b) above.

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- (d) The diagram used in question (b) above is one way to model a molecule of ozone. State one limitation of such a model

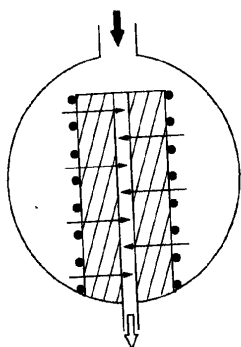
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Question 9 (6 marks)

Given below is a diagram which represents the design of a microscopic membrane filter.



Explain how the filter works and assess the effectiveness of this method of filtration in its use to purify water supply

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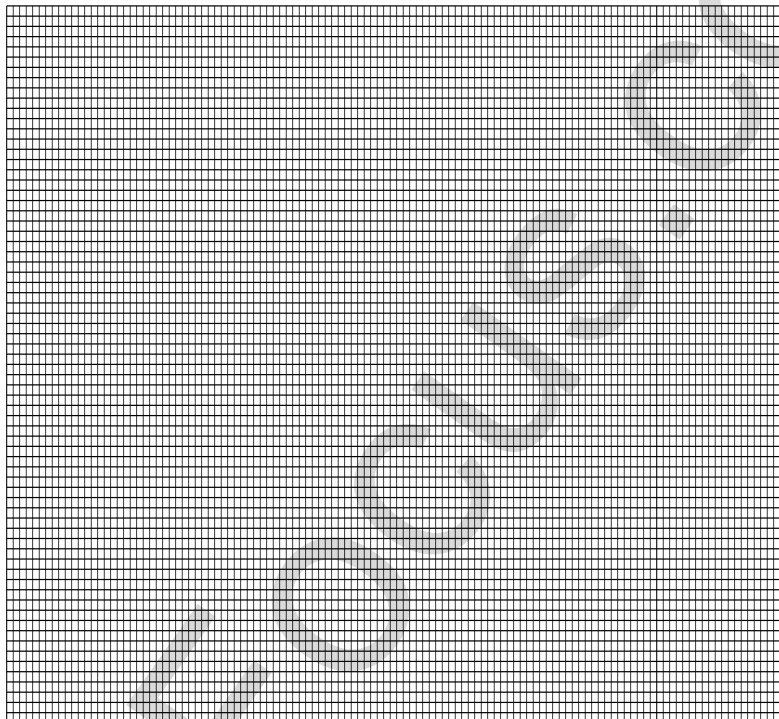
Part B: Atomic Absorption Spectrometry:

The chromium in an aqueous sample was determined by pipetting 10.0 mL of the sample into a 50.0-mL volumetric flask and diluting to volume. The solution was measured by atomic absorption along with four standard solutions of chromium. The results are given below:

<i>Sample</i>	<i>Concentration, ppm</i>	<i>Absorbance</i>
Standard A	2.4	0.091
Standard B	4.8	0.177
Standard C	7.2	0.266
Standard D	9.6	0.353
<i>Unknown Cr</i>	Unknown	0.201

(a) Plot the data

(3 marks)



(b) Calculate the concentration in mol L⁻¹ of Cr in the original sample. (3 marks)

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End of Test