



Chemistry

--	--	--	--	--

Centre Number

Section I (continued)

--	--	--	--	--	--	--	--	--

Student Number

Part B – 60 marks

Attempt Questions 16-28

Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

Marks

Question 16 (2 marks)

Describe the steps in the formation of the addition polymer poly(vinyl chloride).

2

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 17 (9 marks)

Many cosmetics and pharmaceutical preparations require the use of a solvent such as ethanol, which can be produced by the fermentation of sugars or can be derived from crude oil.

- (a) Describe the conditions required to produce ethanol by the fermentation of sugars. **2**

.....

.....

.....

.....

.....

- (b) Explain how mass changes can be used to monitor the fermentation reaction. **2**
Include a suitable equation in your answer.

.....

.....

.....

.....

.....

.....

Question 17 continues on page 11

Question 17 (continued)

- (c) Justify the use of ethanol as a solvent, by referring to the structure of the ethanol molecule. **3**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (d) Identify the steps in the production of ethanol from crude oil. **2**

.....

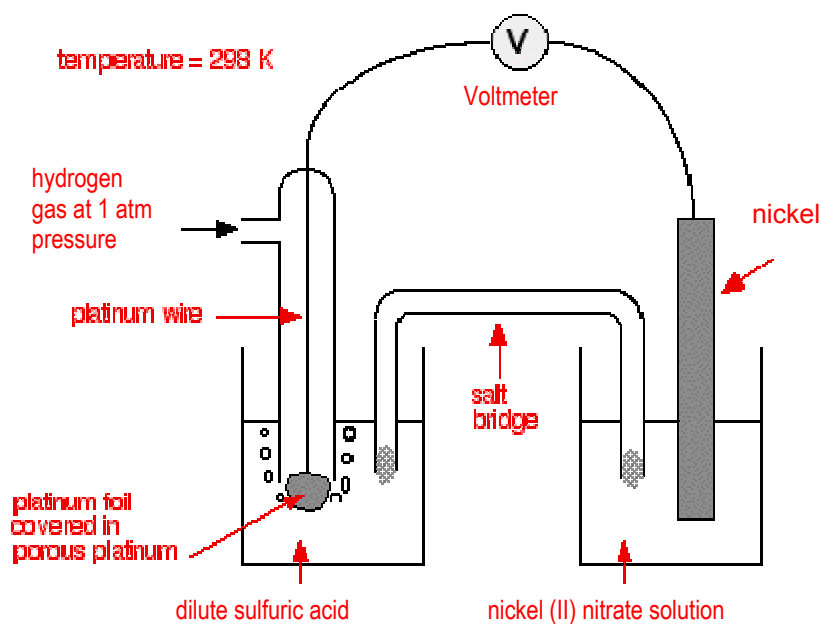
.....

.....

End of Question 17

Question 18 (5 marks)

A group of students constructed the galvanic cell below.



- (a) Write the half-equations for this galvanic cell and, on the diagram above, clearly show the direction of electron flow. 2

.....

.....

- (b) Label the anode and cathode on the diagram of the galvanic cell above. 1

- (c) Suggest TWO reasons why this particular galvanic process is unsuitable as the basis for development of a commercial cell. 2

.....

.....

.....

.....

.....

Question 19 (4 marks)

A scientist placed a rock on top of a few sheets of newspaper, under which was an envelope containing photographic film. After only 5 minutes he removed the photographic film and found that an image in the shape of the rock had developed on the film.

After 28 days, he demonstrated this phenomenon to his colleagues with the same rock, but this time it took 20 minutes for the image to develop to the same intensity.

The table shows properties of some radioactive isotopes.

<i>Name of isotope</i>	<i>Radiation emitted</i>	<i>Approximate half-life</i>
Sodium-24	beta, gamma	15 hours
Bismuth-210	beta	5 days
Iodine-131	beta	7 days
Phosphorus-32	beta	14 days
Radium-225	alpha	14 days
Thorium-227	alpha	28 days
Protactinium-234	beta	28 days

- (a) Use the information about the scientist's experiment and that in the table above to deduce which of these radioactive isotopes the rock may have contained. Explain your choice. 2

.....

.....

.....

.....

.....

- (b) Identify ONE instrument or process, other than the use of a photographic film, which can be used to detect radiation. 1

.....

.....

- (c) Name the isotope which undergoes beta decay to form thorium-227. 1

.....

Question 20 (6 marks)

The role of the solvent is important to our understanding of acids and bases.

- (a) Identify the scientist(s) whose theory of acids first considered solvents other than water. **1**

.....

- (b) Nitrogen dioxide is an acidic oxide that produces acid rain.

- (i) Identify an industrial source of nitrogen dioxide. **1**

.....

.....

- (ii) Explain, using a balanced equation, the formation of acid rain from nitrogen dioxide. **2**

.....

.....

.....

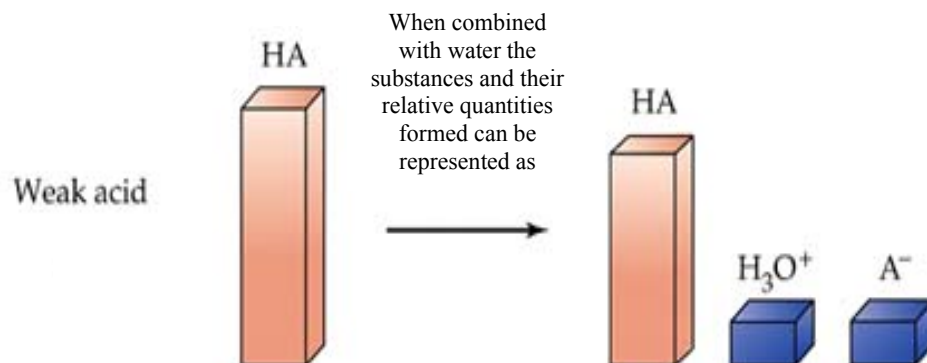
.....

Question 20 continues on page 15

Question 20 (continued)

- (c) A secondary source modelled the ionisation of a weak acid in water using the following diagram.

2



In the space below, show how the diagram would be redrawn to model the change when a strong acid ionises in water.

End of Question 20

(a) Calculate the mass of pure sodium hydroxide required to make 100.0 mL of a 0.100 mol L⁻¹ solution. 2

.....

.....

.....

.....

-
- This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the entire width of the page. There are no margins, text, or other markings present.

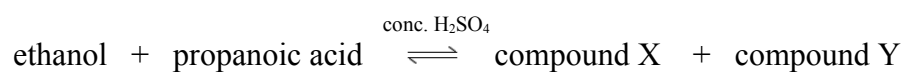
	<i>acetic acid</i>	<i>hydrochloric acid</i>
<i>Concentration of acid</i> (mol L ⁻¹)	1.0	0.0040
<i>Initial pH</i>	2.4	2.4
<i>Substance added</i>	1.0 g solid sodium acetate	1.0 g solid sodium chloride
<i>Final pH</i>	2.6	2.4

5

[illegible]

Question 23 (4 marks)

Consider the following reaction:



- (a) Name and write structural formulae for compounds X and Y.

2

X =

Structural formula for X:

Y =

Structural formula for Y:

- (b) Draw a labelled diagram of the apparatus used to carry out this reaction in the laboratory.

2

Question 24 (4 marks)

“The Haber process is based on a delicate balancing act involving reaction energy, reaction rate and equilibrium.”

4

Analyse this statement.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 25 (4 marks)

- (a) Write a balanced equation for INCOMPLETE combustion of propane. **1**

.....

- (b) “Incomplete combustion of fuels is an issue for society. As a result, combustion reactions require monitoring and management.” **3**

Discuss these statements.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 26 (5 marks)

Human activity has caused changes in the composition and structure of the atmosphere. Chemists monitor changes in the concentration of ozone so that further damage can be limited.

- (a) Outline how the measurements which show the depletion of ozone in the stratosphere are obtained. **2**

.....

.....

.....

.....

.....

.....

- (b) Outline a step taken to reduce the effects of ozone-destroying chemicals in the stratosphere. **1**

.....

.....

.....

.....

- (c) Explain how ozone is destroyed by chemicals such as CFCs in the stratosphere. Include equations in your response. **2**

.....

.....

.....

.....

.....

Question 27 (3 marks)

Discuss the use of chemical additives and membrane filters in the treatment of mass water supplies. **3**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 28 (4 marks)

A chemistry student determined the percentage of sulfate in a lawn fertiliser using the following procedure. He ground the fertiliser into a powder, weighed out 1.03 g of the powder, added it to 250 mL of dilute hydrochloric acid and stirred to dissolve as much as possible of the fertiliser. The insoluble material was then removed by filtration. The filtrate was warmed and a solution of barium chloride was slowly added until no more precipitate formed. The precipitate was allowed to settle. After 30 minutes, the precipitate was filtered through a weighed sintered glass filter, washed, dried and the mass of the precipitate determined.

The precipitate was found to have a mass of 1.80 g.

- (a) Use the above data to calculate the percentage of sulfate in the lawn fertiliser. 2

.....

.....

.....

.....

.....

.....

.....

- (b) The teacher told the student that his answer was not correct and suggested that the washing and drying stages of the experiment might not have been performed adequately. Explain how incorrect techniques during the washing and drying stages could impact on the accuracy of the result. 2

.....

.....

.....

.....

.....

.....

.....

BLANK PAGE