



Student Number	
Mark / 43	

Chemistry

HSC Course

Production of Materials

Theory Test • 2006

General Instructions

- Reading time – 5 minutes
- Working time – 45 minutes
- Write using black or blue pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- A Data Sheet and a Periodic Table are provided
- Write your Student Number at the top of this page

Total Marks – 43

Part A – 12 marks

- Attempt Questions 1 – 12
- Allow about 10 minutes for this part

Part B – 31 marks

- Attempt Questions 13 – 21
- Allow about 40 minutes for this part

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Part A – 12 marks

Attempt Questions 1 – 12

Allow about 10 minutes for this part

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 ☐
correct

Answer Box for Questions 1 – 12

1	A ☐	B ☐	C ☐	D ☐
2	A ☐	B ☐	C ☐	D ☐
3	A ☐	B ☐	C ☐	D ☐
4	A ☐	B ☐	C ☐	D ☐
5	A ☐	B ☐	C ☐	D ☐
6	A ☐	B ☐	C ☐	D ☐
7	A ☐	B ☐	C ☐	D ☐
8	A ☐	B ☐	C ☐	D ☐
9	A ☐	B ☐	C ☐	D ☐
10	A ☐	B ☐	C ☐	D ☐
11	A ☐	B ☐	C ☐	D ☐
12	A ☐	B ☐	C ☐	D ☐

1 Which of the following substances is the major component of biomass?

- (A) carbon dioxide
- (B) cellulose
- (C) glucose
- (D) methane

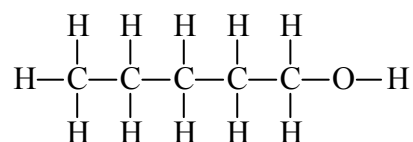
2 What is the main industrial source of ethene from oil refineries?

- (A) Cracking of C_1 – C_2 fractions after distillation of crude oil.
- (B) Cracking of C_{10} – C_{15} fractions after distillation of crude oil.
- (C) Distillation of crude oil.
- (D) Fermentation of sugar from sugar cane.

3 What is the oxidation state of manganese in $KMnO_4$?

- (A) 3+
- (B) 6+
- (C) 7+
- (D) 8+

4 An alkanol has the following molecular structure...



What is the correct IUPAC name for this alkanol?

- (A) 1 – pentanol
- (B) butylmethanol
- (C) pentyl alcohol
- (D) 5 – pentanol

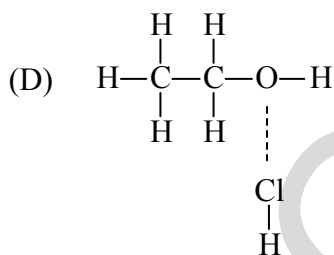
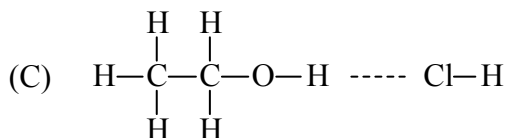
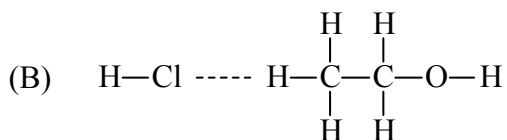
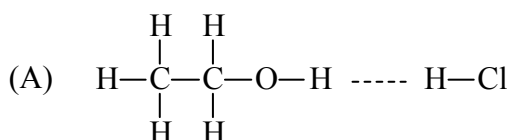
5 Which of these factors will promote the production of ethanol by fermentation?

- (A) abundant oxygen
- (B) cellulase
- (C) limewater
- (D) warmth

6 Which of the following instruments is used to detect radiation?

- (A) electronic balance
- (B) Geiger counter
- (C) oscilloscope
- (D) voltmeter

7 Hydrogen chloride dissolves well in ethanol. Which of the following diagrams shows the interaction between the molecules during the dissolution process?



8 Which reaction is classified as an oxidation/reduction reaction?

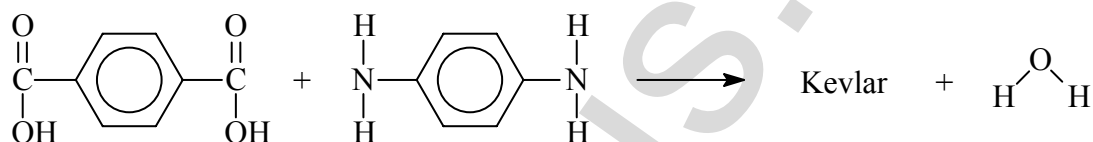
- (A) $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
- (B) $\text{NaOH}(\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{NaCl}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- (C) $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$
- (D) $\text{Zn}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$

- 9 The diagram shows a three-monomer segment of a polymer.



What is the name of the monomer used for the polymer?

- (A) chloroethene
(B) ethene
(C) 1-chloroethane
(D) 1,2-dichloroethene
- 10 Kevlar™ is a synthetic fibre used to make bulletproof vests. It is formed by condensation polymerisation of the monomers, terephthalic acid and phenylenediamine...



Which of the following is the structural formula of Kevlar?

- (A) $\begin{array}{c} \text{O} & & \text{O} \\ || & & || \\ \text{C} & \text{---} & \text{C} \\ | & & | \\ \text{OH} & & \text{OH} \end{array} \text{---} \text{C}_6\text{H}_4 \text{---} \begin{array}{c} \text{H} & & \text{H} \\ | & & | \\ \text{N} & \text{---} & \text{N} \\ | & & | \\ \text{H} & & \text{H} \end{array} \text{---} \text{C}_6\text{H}_4 \text{---} \begin{array}{c} \text{H} & & \text{H} \\ | & & | \\ \text{N} & \text{---} & \text{N} \\ | & & | \\ \text{H} & & \text{H} \end{array}$
- (B) $\begin{array}{c} \text{O} & & \text{O} \\ || & & || \\ \text{C} & \text{---} & \text{C} \\ | & & | \\ \text{OH} & & \text{OH} \end{array} \text{---} \text{C}_6\text{H}_4 \text{---} \begin{array}{c} \text{O} & & \text{H} \\ | & & | \\ \text{C} & \text{---} & \text{N} \\ | & & | \\ \text{OH} & & \text{H} \end{array} \text{---} \text{C}_6\text{H}_4 \text{---} \begin{array}{c} \text{H} & & \text{H} \\ | & & | \\ \text{N} & \text{---} & \text{N} \\ | & & | \\ \text{H} & & \text{H} \end{array}$
- (C) $\begin{array}{c} \text{O} & & \text{O} \\ || & & || \\ \text{C} & \text{---} & \text{C} \\ | & & | \\ \text{OH} & & \text{OH} \end{array} \text{---} \text{C}_6\text{H}_4 \text{---} \begin{array}{c} \text{H} & & \text{H} \\ | & & | \\ \text{N} & \text{---} & \text{N} \\ | & & | \\ \text{H} & & \text{H} \end{array} \text{---} \text{C}_6\text{H}_4 \text{---} \begin{array}{c} \text{H} & & \text{H} \\ | & & | \\ \text{N} & \text{---} & \text{N} \\ | & & | \\ \text{H} & & \text{H} \end{array}$
- (D) $\begin{array}{c} \text{O} & & \text{O} \\ || & & || \\ \text{C} & \text{---} & \text{C} \\ | & & | \\ \text{OH} & & \text{OH} \end{array} \text{---} \text{C}_6\text{H}_4 \text{---} \begin{array}{c} \text{H} & & \text{H} \\ | & & | \\ \text{N} & \text{---} & \text{N} \\ | & & | \\ \text{H} & & \text{H} \end{array} \text{---} \text{C}_6\text{H}_4 \text{---} \begin{array}{c} \text{H} & & \text{H} \\ | & & | \\ \text{N} & \text{---} & \text{N} \\ | & & | \\ \text{H} & & \text{H} \end{array}$

11 Which of the following reactions shows the production of a transuranic element?

- (A) ${}_{92}^{238}\text{U} + {}_0^1\text{n} \rightarrow {}_{93}^{239}\text{Np} + {}_{-1}^0\text{e}$
- (B) ${}_{92}^{234}\text{U} + {}_0^1\text{n} \rightarrow {}_{92}^{235}\text{U}$
- (C) ${}_{92}^{235}\text{U} + {}_0^1\text{n} \rightarrow {}_{56}^{142}\text{Ba} + {}_{36}^{91}\text{Kr} + 3{}_0^1\text{n}$
- (D) ${}_{92}^{233}\text{U} \rightarrow {}_{90}^{229}\text{Th} + {}_2^4\text{He}$

12 The chemistry of two types of galvanic cells, Y and Z, are displayed in the table.

Cell	<i>negative electrode reaction</i>	<i>positive electrode reaction</i>
Y	$\text{Pb} + \text{SO}_4^{2-} \rightarrow \text{PbSO}_4(\text{s}) + 2\text{e}^-$	$\text{PbO}_2 + 4\text{H}^+ + \text{SO}_4^{2-} + 2\text{e}^- \rightarrow \text{PbSO}_4(\text{s}) + 2\text{H}_2\text{O}$
Z	$\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$	$\text{NH}_4^+ + \text{MnO}_2 + \text{H}_2\text{O} + \text{e}^- \rightarrow \text{Mn}(\text{OH})_3 + \text{NH}_3$

Which substance is reduced in each cell's cathode reaction?

	<i>Cell Y</i>	<i>Cell Z</i>
(A)	lead	sulfate
(B)	lead	zinc
(C)	oxygen	nitrogen
(D)	lead(IV) oxide	manganese(IV) oxide

Part B – 31 marks
Attempt Questions 13 – 21
Allow about 40 minutes for this part

► *Show all relevant working in questions involving calculations.*

Question 13 (2 marks)

Explain the high solubility of iodine in ethanol.

Question 14 (3 marks)

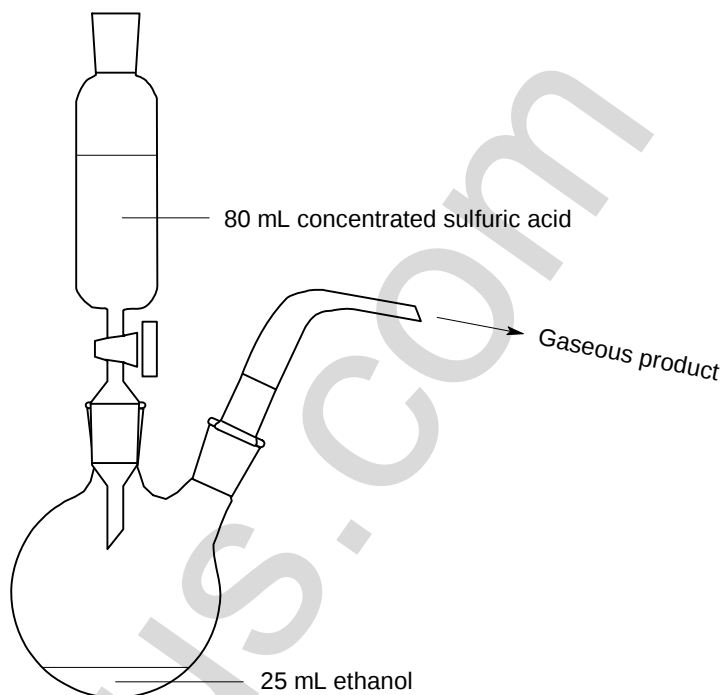
Distinguish between stable and radioactive isotopes and describe conditions under which a nucleus is unstable.

Question 15 (3 marks)

Fowler's *Lecture Experiments in Chemistry* describes the following practical...

Arrange the apparatus as shown in the diagram. Place 25 mL of ethanol in the flask and 80 mL of concentrated sulfuric acid in the dropping funnel.

With care slowly add the sulfuric acid. Heat the mixture cautiously to a steady boil. Collect samples of the gaseous product for testing.



- (a) Write a balanced chemical equation for the reaction occurring in the flask. **(1 mark)**

- (b) Identify the functional group present in the product. **(1 mark)**

- (c) Identify the role of sulfuric acid in the reaction. **(1 mark)**

Question 16 (5 marks)

In Brazil, cars are manufactured to run on pure ethanol and this may soon become a reality in California. Assess the advantages and disadvantages of producing and using pure ethanol as a car fuel.

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Question 17 (4 marks)

Using a named example, outline the steps in the production of an addition polymer.

Question 18 (2 marks)

A group of high school students were investigating the reactivity of cyclohexane and cyclohexene with bromine water. Describe the observations that they would have made.

Question 19 (3 marks)

(a) Draw the structural formula of the monomer that forms polystyrene. **(1 mark)**

(b) Describe one use of polystyrene. **(1 mark)**

(c) Explain the use of polystyrene you have given in (c) in terms of its properties. **(1 mark)**

Question 20 (4 marks)

A list of commercial galvanic cells is provided below:

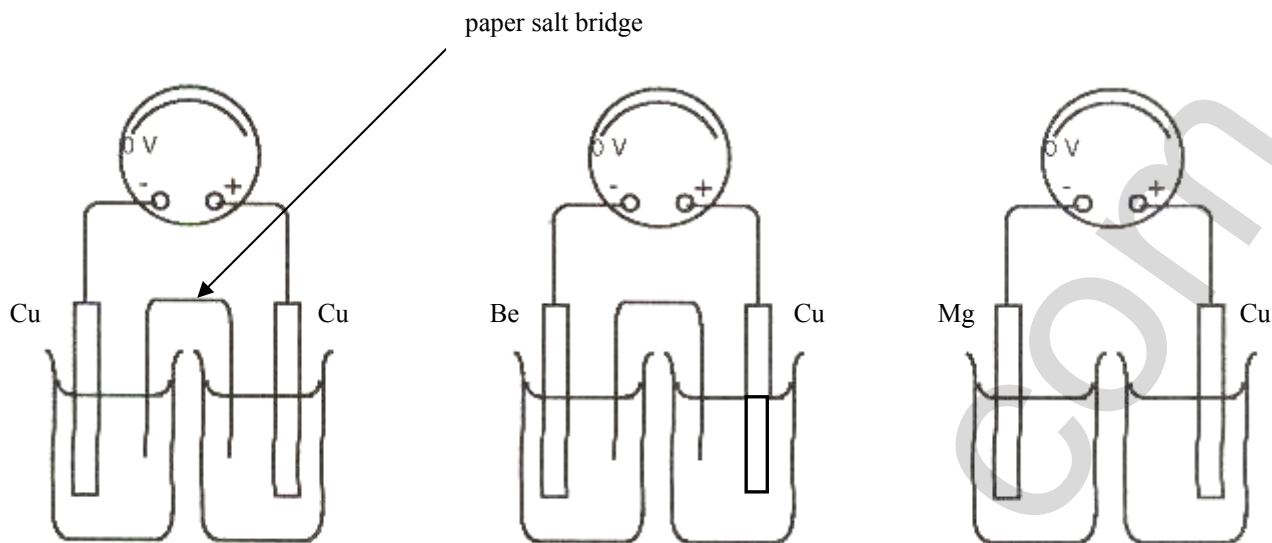
dry cell, lead–acid cell, button cell, fuel cell, vanadium redox cell, lithium cell, liquid junction photovoltaic cell

(a) Compare two of these cells in terms of their use in society. **(2 marks)**

(b) Assess the environmental impact of one of these cells. **(2 marks)**

Question 21 (5 marks)

In order to determine the relative activity of Be, Cu and Mg, a group of students constructed three cells as shown in the diagram, which displays their experimental set up. Each beaker contains a salt solution of the electrode material.



- (a) Describe two variables that would need to be controlled for this investigation. **(2 marks)**

- (b) Evaluate the students' experimental set up. **(3 marks)**
