

Student Number	
Mark / 28	

Chemistry

Production of Materials

Theory Test • 2004

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 at the back of this paper and may be removed for convenience
- Write your Student Number at the top of this page

Total Marks – 28

Part A – 8 marks

- Attempt Questions 1 – 8
- Allow about 15 minutes for this part





Part B – 20 marks

- Attempt Questions 9 – 12
- Allow about 30 minutes for this part

This page is intentionally blank.



Allow about 15 minutes for this part

A  B  C  D 

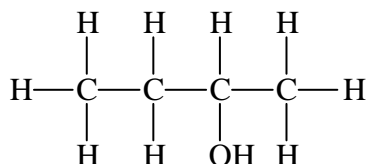
Answer Box for Questions 1 - 8				
1	A <input type="radio"/>	B <input type="radio"/>	C <input type="radio"/>	D <input type="radio"/>
2	A <input type="radio"/>	B <input type="radio"/>	C <input type="radio"/>	D <input type="radio"/>
3	A <input type="radio"/>	B <input type="radio"/>	C <input type="radio"/>	D <input type="radio"/>
4	A <input type="radio"/>	B <input type="radio"/>	C <input type="radio"/>	D <input type="radio"/>
5	A <input type="radio"/>	B <input type="radio"/>	C <input type="radio"/>	D <input type="radio"/>
6	A <input type="radio"/>	B <input type="radio"/>	C <input type="radio"/>	D <input type="radio"/>
7	A <input type="radio"/>	B <input type="radio"/>	C <input type="radio"/>	D <input type="radio"/>
8	A <input type="radio"/>	B <input type="radio"/>	C <input type="radio"/>	D <input type="radio"/>

► *Mark your answers for Questions 1 – 8 in the Answer Box on page 3.*

1 Which of these statements describes the flow of electrons in a galvanic cell?

- (A) Electrons flow from the anode to the cathode.
- (B) Electrons flow from the cathode to the anode.
- (C) Electrons flow through the electrolyte solutions.
- (D) Electrons flow through the salt bridge between the anode and the cathode.

2 What is the IUPAC name for the compound shown below?



- (A) 2-hydroxybutane
- (B) 2-hydroxybutanol
- (C) 2-butanol
- (D) 1-methyl-1-propanol

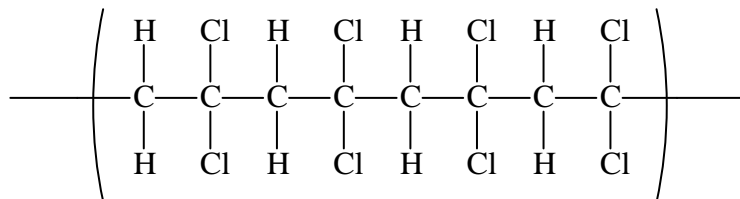
3 Ethanol has good solubility in octane. Which statement best explains this fact?

- (A) Ethanol and octane are non-polar molecules.
- (B) Ethanol and octane are highly volatile.
- (C) Ethanol and octane both have an even number of carbon atoms.
- (D) Ethanol's ethyl group aids its solubility in octane.

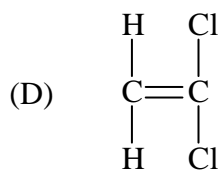
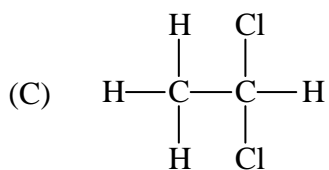
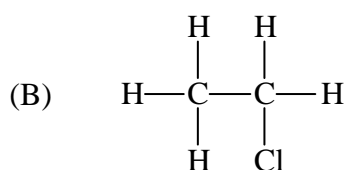
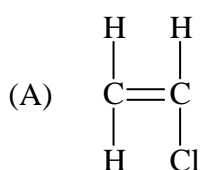
4 Which of the following is the industrial source of ethylene?

- (A) cracking of alkanes
- (B) dehydration of ethanol
- (C) recycling of polyethylene
- (D) fractional distillation of crude oil

- 5 *Saran*TM food wrap is made of an addition polymer processed into a thin, flexible cling film. A segment of the polymer molecule has the structure of...



Which of the following is the structure of the monomer?

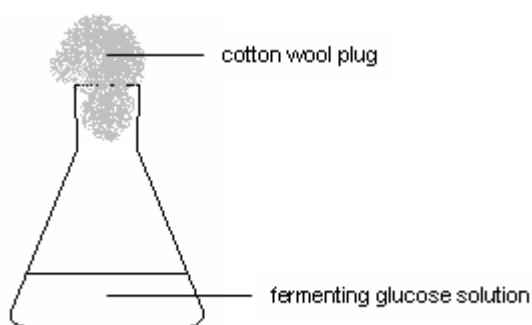


- 6 Assuming no heat loss, what mass of ethanol must be burned to increase the temperature of 250 g of water from 25°C to 95°C, given that the heat of combustion of ethanol is 1409 kJ mol⁻¹?
- (A) 0.86 g
 (B) 2.4 g
 (C) 4.8 g
 (D) 0.86 kg

7 Which equation shows the production of ethanol from ethylene?

- (A) $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \xrightarrow{\text{yeast}} \text{C}_2\text{H}_5\text{OH}$
- (B) $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \xrightarrow{\text{dilute H}_2\text{SO}_4} \text{C}_2\text{H}_5\text{OH}$
- (C) $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \xrightarrow{\text{zeolite}} \text{C}_2\text{H}_5\text{OH}$
- (D) $\text{C}_2\text{H}_4 + \text{HOCl} \xrightarrow{\text{dilute NaOH}} \text{C}_2\text{H}_5\text{OH}$

8 Boris fermented a dilute solution of glucose for one week and then analysed the contents of the fermentation vessel as shown below.
Which trend describes the changes in mass during the week of fermentation?



MASS OF...			
CO ₂ produced	C ₂ H ₅ OH produced	C ₆ H ₁₂ O ₆	Fermentation flask
(A) increased	increased	decreased	increased
(B) decreased	increased	increased	increased
(C) increased	decreased	decreased	decreased
(D) increased	increased	decreased	decreased

Part B – 20 marks

Attempt Questions 9 – 12

Allow about 30 minutes for this part

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

Question 9 (5 marks)

Charlotte performs a first-hand investigation involving a galvanic cell constructed from these materials...

copper metal, 1 mol L⁻¹ copper(II) sulfate, lead metal, 1 mol L⁻¹ lead(II) nitrate, and saturated KNO₃ (aq)

(a) Identify a hazardous risk in this experiment. **(1 mark)**

(b) Identify the anode. **(1 mark)**

(c) Describe the role of the salt bridge containing saturated KNO₃ solution? **(1 mark)**

(d) Charlotte lets the cell run continuously for a week. Describe TWO changes which would have occurred in the cell after one week. **(2 marks)**

Question 10 (5 marks)

Draw a labelled diagram of the structure of EITHER a dry cell or a lead–acid cell and write the oxidation and reduction half reactions occurring in the cell.

Question 11 (5 marks)

Assess the potential of ethanol as an alternative to octane (petrol) as a car fuel.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 12 (5 marks)

- (a) Identify a named biopolymer and the name of the specific organism or enzyme(s) used in its production. **(2 marks)**

- (b) Describe ONE use of the biopolymer in (a) and describe how this use (or potential use) relates to TWO properties of the biopolymer. **(3 marks)**

HIGHER SCHOOL CERTIFICATE EXAMINATION
Chemistry

DATA SHEET

Avogadro constant, N_A	$6.022 \times 10^{23} \text{ mol}^{-1}$
Volume of 1 mole ideal gas: at 100 kPa and	
at 0°C (273.15 K)	22.71 L
at 25°C (298.15 K)	24.79 L
Ionisation constant for water at 25°C (298.15 K), K_w	1.0×10^{-14}
Specific heat capacity of water	$4.18 \times 10^3 \text{ J kg}^{-1} \text{ K}^{-1}$

Some useful formulae

$$\text{pH} = -\log_{10}[\text{H}^+] \qquad \Delta H = -m C \Delta T$$

Some standard potentials

$\text{K}^+ + \text{e}^-$	\rightleftharpoons	K(s)	-2.94 V
$\text{Ba}^{2+} + 2\text{e}^-$	\rightleftharpoons	Ba(s)	-2.91 V
$\text{Ca}^{2+} + 2\text{e}^-$	\rightleftharpoons	Ca(s)	-2.87 V
$\text{Na}^+ + \text{e}^-$	\rightleftharpoons	Na(s)	-2.71 V
$\text{Mg}^{2+} + 2\text{e}^-$	\rightleftharpoons	Mg(s)	-2.36 V
$\text{Al}^{3+} + 3\text{e}^-$	\rightleftharpoons	Al(s)	-1.68 V
$\text{Mn}^{2+} + 2\text{e}^-$	\rightleftharpoons	Mn(s)	-1.18 V
$\text{H}_2\text{O} + \text{e}^-$	\rightleftharpoons	$\frac{1}{2}\text{H}_2(\text{g}) + \text{OH}^-$	-0.83 V
$\text{Zn}^{2+} + 2\text{e}^-$	\rightleftharpoons	Zn(s)	-0.76 V
$\text{Fe}^{2+} + 2\text{e}^-$	\rightleftharpoons	Fe(s)	-0.44 V
$\text{Ni}^{2+} + 2\text{e}^-$	\rightleftharpoons	Ni(s)	-0.24 V
$\text{Sn}^{2+} + 2\text{e}^-$	\rightleftharpoons	Sn(s)	-0.14 V
$\text{Pb}^{2+} + 2\text{e}^-$	\rightleftharpoons	Pb(s)	-0.13 V
$\text{H}^+ + \text{e}^-$	\rightleftharpoons	$\frac{1}{2}\text{H}_2(\text{g})$	0.00 V
$\text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^-$	\rightleftharpoons	$\text{SO}_2(\text{aq}) + 2\text{H}_2\text{O}$	0.16 V
$\text{Cu}^{2+} + 2\text{e}^-$	\rightleftharpoons	Cu(s)	0.34 V
$\frac{1}{2}\text{O}_2(\text{g}) + \text{H}_2\text{O} + 2\text{e}^-$	\rightleftharpoons	2OH^-	0.40 V
$\text{Cu}^+ + \text{e}^-$	\rightleftharpoons	Cu(s)	0.52 V
$\frac{1}{2}\text{I}_2(\text{s}) + \text{e}^-$	\rightleftharpoons	I^-	0.54 V
$\frac{1}{2}\text{I}_2(\text{aq}) + \text{e}^-$	\rightleftharpoons	I^-	0.62 V
$\text{Fe}^{3+} + \text{e}^-$	\rightleftharpoons	Fe^{2+}	0.77 V
$\text{Ag}^+ + \text{e}^-$	\rightleftharpoons	Ag(s)	0.80 V
$\frac{1}{2}\text{Br}_2(\text{l}) + \text{e}^-$	\rightleftharpoons	Br^-	1.08 V
$\frac{1}{2}\text{Br}_2(\text{aq}) + \text{e}^-$	\rightleftharpoons	Br^-	1.10 V
$\frac{1}{2}\text{O}_2(\text{g}) + 2\text{H}^+ + 2\text{e}^-$	\rightleftharpoons	H_2O	1.23 V
$\frac{1}{2}\text{Cl}_2(\text{g}) + \text{e}^-$	\rightleftharpoons	Cl^-	1.36 V
$\frac{1}{2}\text{Cr}_2\text{O}_7^{2-} + 7\text{H}^+ + 3\text{e}^-$	\rightleftharpoons	$\text{Cr}^{3+} + \frac{7}{2}\text{H}_2\text{O}$	1.36 V
$\frac{1}{2}\text{Cl}_2(\text{aq}) + \text{e}^-$	\rightleftharpoons	Cl^-	1.40 V
$\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^-$	\rightleftharpoons	$\text{Mn}^{2+} + 4\text{H}_2\text{O}$	1.51 V
$\frac{1}{2}\text{F}_2(\text{g}) + \text{e}^-$	\rightleftharpoons	F^-	2.89 V

Aylward and Findlay, *SI Chemical Data* (5th Edition) is the principal source of data for this examination paper. Some data may have been modified for examination purposes.

KEY	
Atomic Number	79
	Au
Atomic Weight	197.0
	Gold
	Symbol of element
	Name of element

Lanthanides

Actinides

Where the atomic weight is not known, the relative atomic mass of the most common radioactive isotope is shown in brackets. The atomic weights of Np and Tc are given for the isotopes ^{237}Np and ^{99}Tc .