

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

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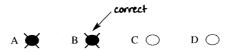
Part A - 8 marks Attempt Questions 1–8 Allow about 15 minutes for this part

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 \bigcirc B \bigcirc C \bigcirc D \bigcirc

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

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.



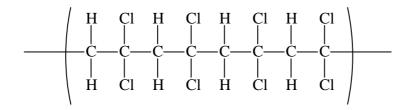
Ans	wer Bo	x for Q	uestions	1 - 8
1	A O	вО	СО	D O
2	A O	вО	СО	D O
3	A O	вО	СО	D O
4	A O	вО	СО	DO
5	A O	вО	СО	D O
6	A O	вО	СО	DO
7	A O	вО	СО	DO
8	A O	вО	СО	D O

► 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.
- 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[™] 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?

- 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

Which equation shows the production of ethanol from ethylene?

$$(A) \qquad C_2H_4 \ + \ H_2O \ \xrightarrow{\ yeast \ } \ C_2H_5OH$$

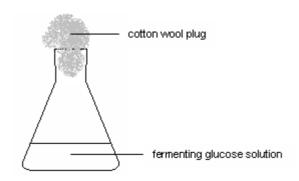
$$(B) \hspace{0.5cm} C_2H_4 \hspace{0.1cm} + \hspace{0.1cm} H_2O \hspace{0.1cm} \xrightarrow{\hspace{0.1cm} \text{dilute H_2SO_4}} \hspace{0.1cm} C_2H_5OH$$

$$(C) \qquad C_2H_4 \ + \ H_2O \ \xrightarrow{\ zeolite \ } \ C_2H_5OH$$

(D)
$$C_2H_4 + HOC1 \xrightarrow{\text{dilute NaOH}} C_2H_5OH$$

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	C₂H₅OH 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)			
Ques				
	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 KNO _{3 (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 KNO ₃ 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.			

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

Question 11 (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)

Question 12 (5 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		
_	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

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

Some standard potentials

$K^+ + e^-$	~	K(s)	-2.94 V
$Ba^{2+} + 2e^{-}$	_	Ba(s)	-2.91 V
$Ca^{2+} + 2e^{-}$	~_	Ca(s)	–2.87 V
$Na^+ + e^-$	~	Na(s)	–2.71 V
$Mg^{2+} + 2e^{-}$	₹	Mg(s)	-2.36 V
$A1^{3+} + 3e^{-}$	\rightleftharpoons	Al(s)	-1.68 V
$Mn^{2+} + 2e^{-}$	~>	Mn(s)	-1.18 V
H ₂ O + e ⁻	\rightleftharpoons	$\frac{1}{2}H_2(g) + OH^-$	-0.83 V
$Zn^{2+} + 2e^{-}$	\leftarrow	Zn(s)	-0.76 V
$Fe^{2+} + 2e^{-}$	$\stackrel{\longleftarrow}{}$	Fe(s)	-0.44 V
$Ni^{2+} + 2e^{-}$	\rightleftharpoons	Ni(s)	-0.24 V
$Sn^{2+} + 2e^{-}$	\rightleftharpoons	Sn(s)	-0.14 V
$Pb^{2+} + 2e^{-}$	\rightleftharpoons	Pb(s)	-0.13 V
$H^+ + e^-$	\rightleftharpoons	$\frac{1}{2}$ H ₂ (g)	0.00 V
$SO_4^{2-} + 4H^+ + 2e^-$	~	$SO_2(aq) + 2H_2O$	0.16 V
$Cu^{2+} + 2e^{-}$	\rightleftharpoons	Cu(s)	0.34 V
$\frac{1}{2}O_2(g) + H_2O + 2e^-$	\rightleftharpoons	2OH-	0.40 V
$Cu^+ + e^-$	~	Cu(s)	0.52 V
$\frac{1}{2}I_2(s) + e^-$	/	I-	0.54 V
$\frac{1}{2}I_2(aq) + e^{-}$	\rightleftharpoons	I-	0.62 V
$Fe^{3+} + e^{-}$	\rightleftharpoons	Fe ²⁺	0.77 V
$Ag^+ + e^-$	$\stackrel{\longleftarrow}{}$	Ag(s)	0.80 V
$\frac{1}{2}\mathrm{Br}_2(l) + \mathrm{e}^-$	\rightleftharpoons	Br ⁻	1.08 V
$\frac{1}{2}\mathrm{Br}_2(aq) + \mathrm{e}^-$	\rightleftharpoons	Br ⁻	1.10 V
$\frac{1}{2}O_2(g) + 2H^+ + 2e^-$	~>	H ₂ O	1.23 V
$\frac{1}{2}\mathrm{Cl}_2(g) + \mathrm{e}^-$	\rightleftharpoons	Cl ⁻	1.36 V
$\frac{1}{2}$ Cr ₂ O ₇ ²⁻ + 7H ⁺ + 3e ⁻	\rightleftharpoons	$Cr^{3+} + \frac{7}{2}H_2O$	1.36 V
$\frac{1}{2}\text{Cl}_2(aq) + e^-$	\rightleftharpoons	Cl ⁻	1.40 V
$MnO_4^- + 8H^+ + 5e^-$	\rightleftharpoons	$Mn^{2+} + 4H_2O$	1.51 V
$\frac{1}{2}$ F ₂ (g) + 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.

1 H 1.008 Hydrogen Hydrogen G.941 Lithium 11 Na 22.99 Sodium 19 K 39.10 Potassium Rb 85.47 Rubidium 85.5 Cs Cs 132.9 Caesium 87 Fr [223.0 Francium 87 4 Be 9,012 Beyllium 12 Mg 24,31 Magnesium 20 Ca 40.08 Calcium 38 Sr 87,62 Sroantium 137,3 Barium 88 Ra 137,3 Barium 88 21 Sc 44.96 Scandium 39 Y 88.91 Yurium 57-71 22 Ti 47.87 Tranium 40 Zr 91.22 Zirconium 72 Hf 178.5 Hafnium 104 Rf [261.1] 24 Cr 52.00 Chromium 42 Mo 95.94 Molybdenu 74 W 183.8 Tungsten 106 Sg Sg [263.1] PERIODIC TABLE OF THE ELEMENTS 25 Min 54.94 Manganese 43 Tc [98.91] Technetium 75 Re 186.2 Rhenium 107 Bh 26 Fe 55.85 Iron 144 Ru 101.1 Ruthenium 76 Os 190.2 Osmium 108 Hs 1265.1 27 Co 58.93 Cobalt 45 Rh 102.9 Rhodium 77 Ir 192.2 Iridium 1199.2 Iridium 1199.8 79 Au 197.0 Gold 28 Ni S8.69 Nickel 46 Pd 1106.4 Palladium 78 Pt 195.1 Platinum 110 Uun 29 Cu 63.55 Copper 47 Aq Ag 107.9 Silver 79 Au 197.0 Gold 1111 Uuu Uuununiu 30 Zn 65.39 Zinc 48 Cd 112.4 Cadmium Cadmium 80 Hg 200.6 Mercury 112 Uub 5 B B 10.81 Boron 13 Al 26.98 Aluminium 31 Gallium 49 In 114.8 Indium 81 Tri 204.4 Thallium 1113 6 C I2.01 Carbon I4 Si Silicon Silicon Silicon Silicon I18.7 Tin Tin I18.7 Ticad Utuqudii Utuunquadii 7 N Nitrogen 15 P 30.97 30.97 30.97 30.97 30.97 Arsenic 51 Sb 121.8 Antimony 83 Bi 209.0 Bismuth 8 0 16.00 Oxygen Suffix Se 32.07 Sulfur Se 78.96 Scienium Tellurium Tellurium Polonium Polonium 116 Uuh 9 F 19.00 Fluorine 17 Cl 35.45 Chlorine 35 Br 79.90 Bromine 53 I 1126.9 Iodine 85 At At Assatine 117 2 He 4,003 Helium 10 Ne 20.18 Neon 18 Neon 18 Ar 39,95 Argon Kr 83.80 Krypton 54 Xe 131.3 Xenon 86 Rn 118 Utuo Ununoccium

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

Lanthanides
57
La
138.9
Lanthanum

58 Ce 140.1

59 Pr 140.9 Praseodymium

60 Nd 144.2 Neodymium

61 Pm [146.9] Promethium

62 Sm 150.4 Samarium

63 Eu 152.0 Europium

64 Gd 157.3 Gadolinium

65 Tb 158.9 Terbium

Dy 162.5 Dysprosium

67 Ho 164.9 Holmium

68 Er 167.3 Erbium

69 Tm 168.9

70 Yb 173.0 Ytterbium

71 Lu 175.0 Lutetium

Actinides Ac [227.0] Actinium

90 Th 232.0 Thorium

92 U 238.0 Uranium

93 Np [237.0] Neptunium

94 Pu [239.1]

95 Am [241.1]

96 Cm [244.1]

97 Bk [249.1] Berkelium

98 Cf [252.1] Californium

99 Es [252.1] Einsteiniun

100 Fm [257.1] Fermium

101 Md [258.1] Mendeleviu

102 No [259.1]

103 Lr [262.1] Lawrenciun