



Student Number	
Mark / 35	

Chemistry

Production of Materials

Theory Test • 2003

General Instructions

- Reading time – 5 minutes
- Working time – 55 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
- Write your Student Number at the top of this page

Total Marks – 35

Part A – 10 marks

- Attempt Questions 1 – 10
- Allow about 15 minutes for this part

Part B – 25 marks

- Attempt Questions 11 – 15
- Allow about 40 minutes for this part

Part A – 10 marks

Attempt Questions 1–10

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 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 1–10				
1	A <input type="radio"/>	B <input type="radio"/>	C <input type="radio"/>	D <input type="radio"/>
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► Mark your answers for Questions 1 – 10 in the Answer Box on page 1.

- 1 Which of the following is a transuranic element?
- (A) bohrium
 - (B) thallium
 - (C) thorium
 - (D) thulium
- 2 Which of the following occurs when a polymer is formed by condensation polymerisation?
- (A) The mass of the polymer formed is less than the combined mass of the reactants.
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- 3 Ethanol is a solvent for many substances. Which of the following statements is an *incorrect* explanation of ethanol's solubility?
- (A) Ethanol has an OH group which helps it dissolve polar molecules.
 - (B) Ethanol can form hydrogen bonds with water.
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 - (D) Ethanol has an OH group which helps it dissolve ionic substances.
- 4 Which of the following is a monomer for cellulose?
- (A) β-glucose
 - (B) β-cellulase
 - (C) starch
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- 5 A student correctly sets up an experiment to convert glucose into ethanol. She monitored the mass of the reaction flask over a few days and found that her reaction flask decreased in mass by 4.4 grams. What mass of ethanol was produced?
- (A) 0 g
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- 6 How can ethylene be obtained from crude oil?
- (A) By separating out the lighter components by fractional distillation.
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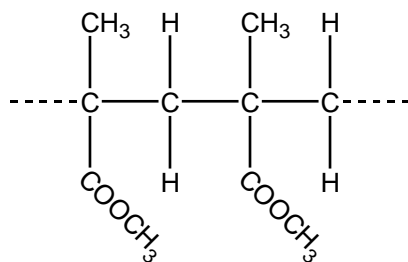
- 7 A student burns ethanol in a spirit burner to heat 150 mL of water. His results are...

Initial temperature of water	24.5 °C
Final temperature of water	74.5 °C
Initial mass of burner + ethanol	236.3 g
Final mass of burner + ethanol	234.3 g

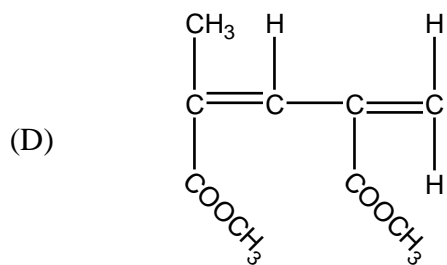
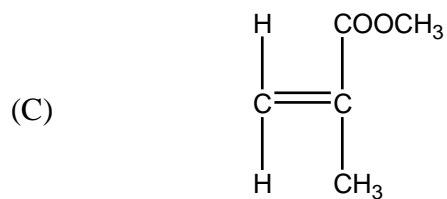
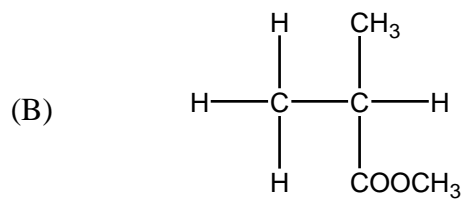
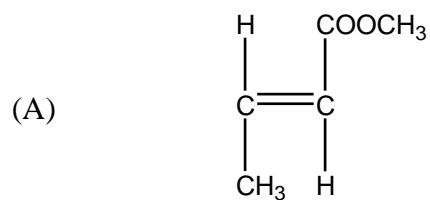
What is the heat of combustion per gram of ethanol from this student's results?

- (A) 31,350 kJ
 - (B) 15,675 J
 - (C) 418 J
 - (D) 31,350 J
- 8 Which list shows the metals in order of increasing activity according to the standard potentials data?
- (A) Ag, Fe, Cu, Ni
 - (B) Fe, Al, Mn, Ca
 - (C) Pb, Fe, Ca, Na
 - (D) Cu, Mn, Na, Ba
- 9 In which species is manganese in the lowest oxidation state?
- (A) MnO_4^{2-}
 - (B) MnO_4^-
 - (C) MnO
 - (D) Mn_2O_3

10 An addition polymer used in the manufacture of artificial eyes has the structure...



Which of the following chemicals is the monomer for this polymer?



Part B – 25 marks

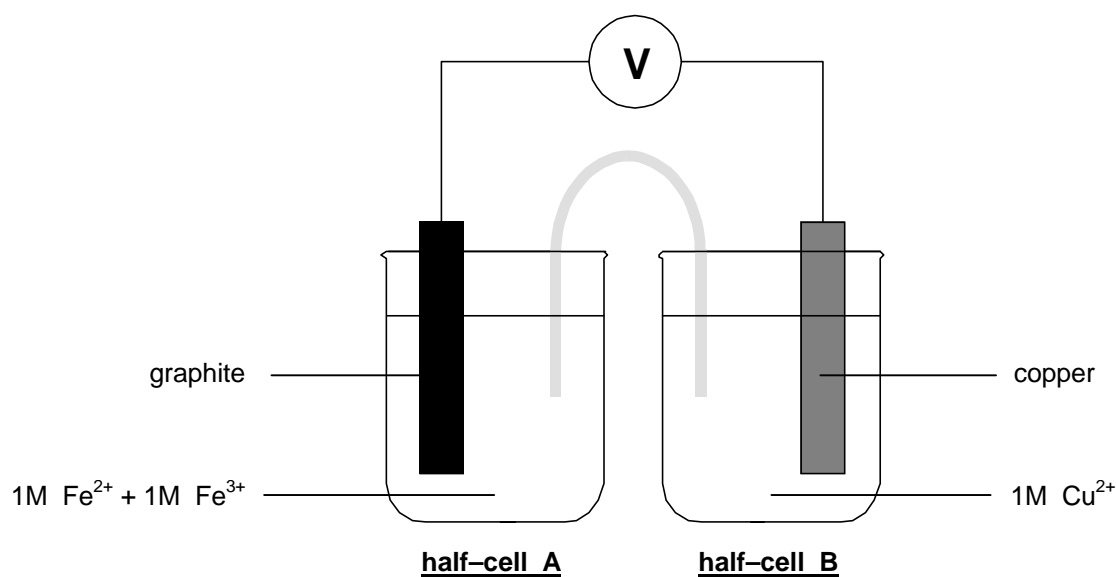
Attempt Questions 11 – 15

Allow about 40 minutes for this part

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

Question 11 (4 marks)

The diagram shows a galvanic cell composed of two half-cells connected by a salt bridge...



After operating for several hours chemical changes are evident.

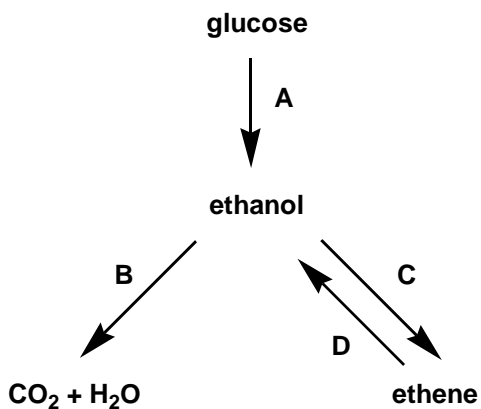
The reaction occurring in half-cell A is... $\text{Fe}^{3+}_{(\text{aq})} + \text{e}^{-} \rightarrow \text{Fe}^{2+}_{(\text{aq})}$

- (a) Indicate the direction of electron flow on the diagram. **(1 mark)**
- (b) Describe two changes that would be visible in half-cell B after several hours? **(2 marks)**

- (c) Calculate the net voltage of the galvanic cell. **(1 mark)**

Question 12 (9 marks)

Identify the type of reaction (A, B, C & D) in the flow chart and write a balanced chemical equation for each reaction. ► *Include states of matter and conditions.*



Reaction	Type of Reaction (4 marks)
A	
B	
C	
D	

Reaction	Chemical Equation (5 marks)
A	
B	
C	
D	

Question 13 (4 marks)

(a) Describe two conditions under which a nucleus is unstable. **(2 marks)**

(b) What is the effect of a nucleus being unstable? **(1 mark)**

(c) Identify an instrument that could be used to detect a substance that has unstable nuclei. **(1 mark)**

Question 14 (5 marks)

- (a) Give an equation (using structural formulae) for the reaction between ethylene and bromine water and name the organic product. **(2 marks)**

- (b) (i) Identify the systematic name for styrene. **(1 mark)**

- (ii) Describe **one** use for polystyrene and identify a property which makes it useful for this purpose. **(2 marks)**

Question 15 (3 marks)

Complete the table for either a dry cell or lead–acid cell...

	TYPE OF CELL Dry cell <u>or</u> Lead–acid cell (circle your choice above)
Identify the composition of the anode	
Write the reduction half–equation	
<u>One</u> advantage of the cell	

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.

PERIODIC TABLE OF THE ELEMENTS

		KEY			
Atomic Number	Symbol of element	Atomic Weight	Name of element		
1 H 1.008 Hydrogen				5 B 10.81 Boron	10 Ne 20.18 Neon
2 He 4.003 Helium				6 C 12.01 Carbon	11 Na 22.99 Sodium
3 Li 6.941 Lithium		79 Au 197.0 Gold		7 N 14.01 Nitrogen	12 Mg 24.31 Magnesium
4 Be 9.012 Beryllium				8 O 16.00 Oxygen	13 Al 26.98 Aluminum
5 B 10.81 Boron				9 F 19.00 Fluorine	14 Si 28.09 Silicon
6 C 12.01 Carbon				10 Ne 20.18 Neon	15 P 30.97 Phosphorus
7 N 14.01 Nitrogen				11 Na 22.99 Sodium	16 S 32.07 Sulfur
8 O 16.00 Oxygen				12 Mg 24.31 Magnesium	17 Cl 35.45 Chlorine
9 F 19.00 Fluorine				13 Al 26.98 Aluminum	18 Ar 39.95 Argon
10 Ne 20.18 Neon				14 Si 28.09 Silicon	19 K 39.10 Potassium
11 Na 22.99 Sodium				15 P 30.97 Phosphorus	20 Ca 40.08 Calcium
12 Mg 24.31 Magnesium				16 S 32.07 Sulfur	21 Sc 44.96 Scandium
13 Al 26.98 Aluminum				17 Cl 35.45 Chlorine	22 Ti 47.87 Titanium
14 Si 28.09 Silicon				18 Ar 39.95 Argon	23 V 50.94 Vanadium
15 P 30.97 Phosphorus				19 K 39.10 Potassium	24 Cr 52.00 Chromium
16 S 32.07 Sulfur				20 Ca 40.08 Calcium	25 Mn 54.94 Manganese
17 Cl 35.45 Chlorine				21 Sc 44.96 Scandium	26 Fe 55.85 Iron
18 Ar 39.95 Argon				22 Ti 47.87 Titanium	27 Co 58.93 Cobalt
19 K 39.10 Potassium				23 V 50.94 Vanadium	28 Ni 58.69 Nickel
20 Ca 40.08 Calcium				24 Cr 52.00 Chromium	29 Cu 63.55 Copper
21 Sc 44.96 Scandium				25 Mn 54.94 Manganese	30 Zn 65.39 Zinc
22 Ti 47.87 Titanium				26 Fe 55.85 Iron	31 Ga 69.72 Gallium
23 V 50.94 Vanadium				27 Co 58.93 Cobalt	32 Ge 72.61 Germanium
24 Cr 52.00 Chromium				28 Ni 58.69 Nickel	33 As 74.92 Arsenic
25 Mn 54.94 Manganese				29 Cu 63.55 Copper	34 Se 78.96 Selenium
26 Fe 55.85 Iron				30 Zn 65.39 Zinc	35 Br 79.90 Bromine
27 Co 58.93 Cobalt				31 Ga 69.72 Gallium	36 Kr 83.80 Krypton
28 Ni 58.69 Nickel				32 Ge 72.61 Germanium	37 Rb 85.47 Rubidium
29 Cu 63.55 Copper				33 As 74.92 Arsenic	38 Sr 87.62 Strontium
30 Zn 65.39 Zinc				34 Se 78.96 Selenium	39 Y 88.91 Yttrium
31 Ga 69.72 Gallium				35 Br 79.90 Bromine	40 Zr 91.22 Zirconium
32 Ge 72.61 Germanium				36 Kr 83.80 Krypton	41 Nb 92.91 Niobium
33 As 74.92 Arsenic				37 Rb 85.47 Rubidium	42 Mo 95.94 Molybdenum
34 Se 78.96 Selenium				38 Sr 87.62 Strontium	43 Tc [98.91] Technetium
35 Br 79.90 Bromine				39 Y 88.91 Yttrium	44 Ru 101.1 Ruthenium
36 Kr 83.80 Krypton				40 Zr 91.22 Zirconium	45 Rh 102.9 Rhodium
37 Rb 85.47 Rubidium				41 Nb 92.91 Niobium	46 Pd 106.4 Palladium
38 Sr 87.62 Strontium				42 Mo 95.94 Molybdenum	47 Ag 107.9 Silver
39 Y 88.91 Yttrium				43 Tc [98.91] Technetium	48 Cd 112.4 Cadmium
40 Zr 91.22 Zirconium				44 Ru 101.1 Ruthenium	49 In 114.8 Indium
41 Nb 92.91 Niobium				45 Rh 102.9 Rhodium	50 Sn 118.7 Tin
42 Mo 95.94 Molybdenum				46 Pd 106.4 Palladium	51 Sb 121.8 Antimony
43 Tc [98.91] Technetium				47 Ag 107.9 Silver	52 Te 127.6 Tellurium
44 Ru 101.1 Ruthenium				48 Cd 112.4 Cadmium	53 I 126.9 Iodine
45 Rh 102.9 Rhodium				49 In 114.8 Indium	54 Xe 131.3 Xenon
46 Pd 106.4 Palladium				50 Sn 118.7 Tin	55 Cs 132.9 Caesium
47 Ag 107.9 Silver				51 Sb 121.8 Antimony	56 Ba 137.3 Barium
48 Cd 112.4 Cadmium				52 Te 127.6 Tellurium	57 La 138.9 Lanthanum
49 In 114.8 Indium				53 I 126.9 Iodine	58 Ce 140.1 Cerium
50 Sn 118.7 Tin				54 Xe 131.3 Xenon	59 Pr 140.9 Praseodymium
51 Sb 121.8 Antimony				55 Cs 132.9 Caesium	60 Nd 144.2 Neodymium
52 Te 127.6 Tellurium				56 Ba 137.3 Barium	61 Pm [146.9] Promethium
53 I 126.9 Iodine				57 La 138.9 Lanthanum	62 Sm 150.4 Samarium
54 Xe 131.3 Xenon				58 Ce 140.1 Cerium	63 Eu 152.0 Europium
55 Cs 132.9 Caesium				59 Pr 140.9 Praseodymium	64 Gd 157.3 Gadolinium
56 Ba 137.3 Barium				60 Nd 144.2 Neodymium	65 Tb 158.9 Terbium
57 La 138.9 Lanthanum				61 Pm [146.9] Promethium	66 Dy 162.5 Dysprosium
58 Ce 140.1 Cerium				62 Sm 150.4 Samarium	67 Ho 164.9 Holmium
59 Pr 140.9 Praseodymium				63 Eu 152.0 Europium	68 Er 167.3 Erbium
60 Nd 144.2 Neodymium				64 Gd 157.3 Gadolinium	69 Tm 168.9 Thulium
61 Pm [146.9] Promethium				65 Tb 158.9 Terbium	70 Yb 173.0 Ytterbium
62 Sm 150.4 Samarium				66 Dy 162.5 Dysprosium	71 Lu 175.0 Lutetium
63 Eu 152.0 Europium				67 Ho 164.9 Holmium	
64 Gd 157.3 Gadolinium				68 Er 167.3 Erbium	
65 Tb 158.9 Terbium				69 Tm 168.9 Thulium	
66 Dy 162.5 Dysprosium				70 Yb 173.0 Ytterbium	
67 Ho 164.9 Holmium				71 Lu 175.0 Lutetium	
68 Er 167.3 Erbium					
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71 Lu 175.0 Lutetium					

Lanthanides		Actinides	
57 La 138.9 Lanthanum	58 Ce 140.1 Cerium	89 Ac [227.0] Actinium	90 Th 232.0 Thorium
59 Pr 140.9 Praseodymium	59 Pr 140.9 Praseodymium	91 Pa 231.0 Protactinium	91 Pa 231.0 Protactinium
60 Nd 144.2 Neodymium	60 Nd 144.2 Neodymium	92 U 238.0 Uranium	92 U 238.0 Uranium
61 Pm [146.9] Promethium	61 Pm [146.9] Promethium	93 Np [237.0] Neptunium	93 Np [237.0] Neptunium
62 Sm 150.4 Samarium	62 Sm 150.4 Samarium	94 Pu [239.1] Plutonium	94 Pu [239.1] Plutonium
63 Eu 152.0 Europium	63 Eu 152.0 Europium	95 Am [241.1] Americium	95 Am [241.1] Americium
64 Gd 157.3 Gadolinium	64 Gd 157.3 Gadolinium	96 Cm [244.1] Curium	96 Cm [244.1] Curium
65 Tb 158.9 Terbium	65 Tb 158.9 Terbium	97 Bk [249.1] Berkelium	97 Bk [249.1] Berkelium
66 Dy 162.5 Dysprosium	66 Dy 162.5 Dysprosium	98 Cf [252.1] Californium	98 Cf [252.1] Californium
67 Ho 164.9 Holmium	67 Ho 164.9 Holmium	99 Es [252.1] Einsteinium	99 Es [252.1] Einsteinium
68 Er 167.3 Erbium	68 Er 167.3 Erbium	100 Fm [257.1] Fermium	100 Fm [257.1] Fermium
69 Tm 168.9 Thulium	69 Tm 168.9 Thulium	101 Md [258.1] Mendelevium	101 Md [258.1] Mendelevium
70 Yb 173.0 Ytterbium	70 Yb 173.0 Ytterbium	102 No [259.1] Nobelium	102 No [259.1] Nobelium
71 Lu 175.0 Lutetium	71 Lu 175.0 Lutetium	103 Lr [262.1] Lawrencium	103 Lr [262.1] Lawrencium

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 ²³⁷Np and ⁹⁹Tc.



ANSWERS and MARKING SCHEME

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Production of Materials

Theory Test • 2003

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 - (B) thallium
 - (C) thorium
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- 2 Which of the following occurs when a polymer is formed by condensation polymerisation?
- (A) The mass of the polymer formed is less than the combined mass of the reactants.
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 - (C) Only one product is formed in the reaction.
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 - (B) Ethanol can form hydrogen bonds with water.
 - (C) Ethanol has a CH₃CH₂ chain which helps it form covalent bonds with non-polar substances.
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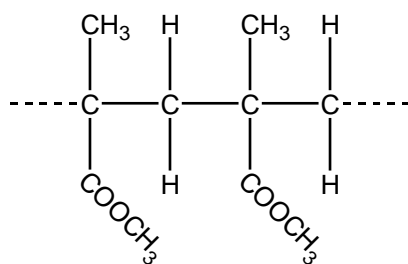
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Initial temperature of water	24.5 °C
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Final mass of burner + ethanol	234.3 g

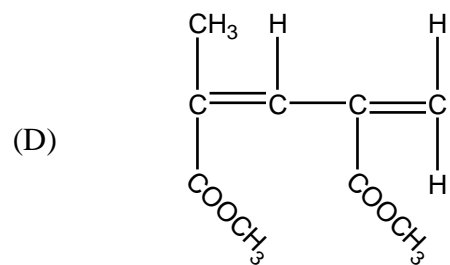
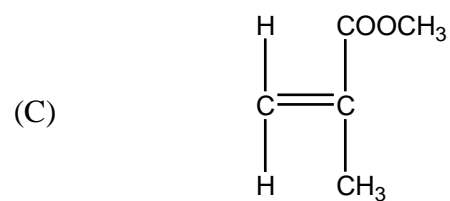
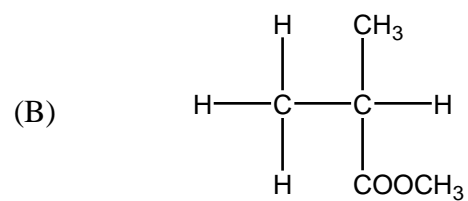
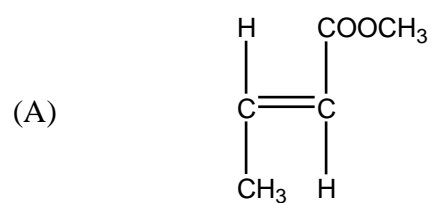
What is the heat of combustion per gram of ethanol from this student's results?

- (A) 31,350 kJ
 - (B) 15,675 J
 - (C) 418 J
 - (D) 31,350 J
- 8 Which list shows the metals in order of increasing activity according to the standard potentials data?
- (A) Ag, Fe, Cu, Ni
 - (B) Fe, Al, Mn, Ca
 - (C) Pb, Fe, Ca, Na
 - (D) Cu, Mn, Na, Ba
- 9 In which species is manganese in the lowest oxidation state?
- (A) MnO_4^{2-}
 - (B) MnO_4^-
 - (C) MnO
 - (D) Mn_2O_3

10 A polymer used in the manufacture of artificial eyes has the structure...



Which of the following chemicals is the monomer for this polymer?



Part B – 25 marks

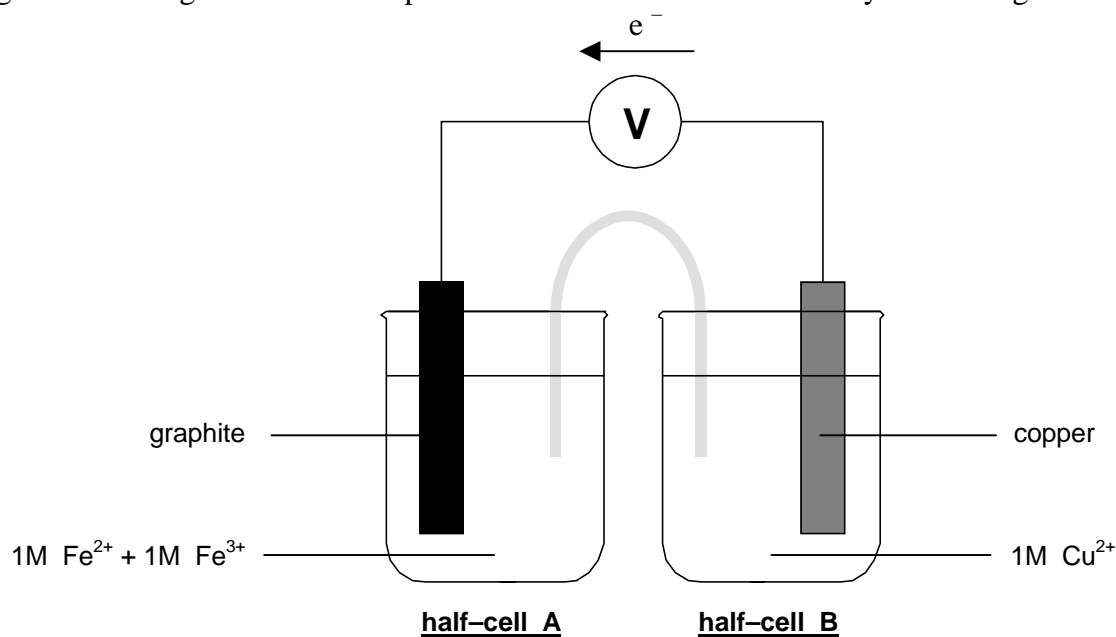
Attempt Questions 11 – 15

Allow about 40 minutes for this part

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

Question 11 (4 marks)

The diagram shows a galvanic cell composed of two half-cells connected by a salt bridge...



After operating for several hours chemical changes are evident.

The reaction occurring in half-cell A is... $\text{Fe}^{3+}_{(\text{aq})} + \text{e}^{-} \rightarrow \text{Fe}^{2+}_{(\text{aq})}$

(a) Indicate the direction of electron flow on the diagram. (1 mark)

(b) What changes would be visible in half-cell B after several hours? (2 marks)

The copper electrode becomes thinner. (1 mark)

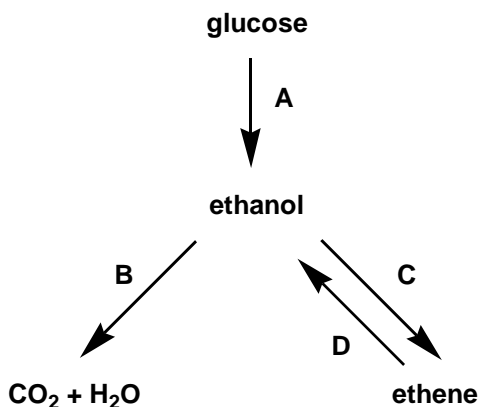
The blue colour of the Cu^{2+} electrolyte becomes darker. (1 mark)

(c) Calculate the net voltage of the galvanic cell. (1 mark)

$$E^{\circ}_{\text{net}} = E^{\circ}_{\text{ox}} + E^{\circ}_{\text{red}} = -0.34 \text{ V} + 0.77 \text{ V} = +0.43 \text{ V}$$

Question 12 (9 marks)

Identify the type of reaction (A, B, C & D) in the flow chart and write a balanced chemical equation for each reaction. ► *Include states of matter and conditions.*



Reaction	Type of Reaction (4 marks)
A	Fermentation
B	Combustion
C	Dehydration
D	Addition or hydration

Reaction	Chemical Equation (5 marks)
A	$\text{C}_6\text{H}_{12}\text{O}_6 \text{ (aq)} \xrightarrow{\text{Yeast (zymase)}} 2\text{CO}_2 \text{ (g)} + 2\text{C}_2\text{H}_5\text{OH} \text{ (aq)}$
B	$\text{C}_2\text{H}_5\text{OH} \text{ (l)} + 3\text{O}_2 \text{ (g)} \rightarrow 2\text{CO}_2 \text{ (g)} + 3\text{H}_2\text{O} \text{ (l or g)}$
C	$\text{C}_2\text{H}_5\text{OH} \text{ (l)} \xrightarrow{\text{conc. H}_2\text{SO}_4 + \text{heat}} \text{C}_2\text{H}_4 \text{ (g)} + \text{H}_2\text{O} \text{ (l or g)}$
D	$\text{C}_2\text{H}_4 \text{ (g)} + \text{H}_2\text{O} \text{ (g)} \xrightarrow{\text{H}_2\text{SO}_4 \text{ or H}_3\text{PO}_4 + \text{heat}} \text{C}_2\text{H}_5\text{OH} \text{ (l)}$

Question 13 (4 marks)

(a) Describe two conditions under which a nucleus is unstable. **(2 marks)**

(i) **The ratio of neutrons to protons is unstable. (1 mark)**

(ii) **Large atomic number (greater than 83). (1 mark)**

(b) What is the effect of a nucleus being unstable? **(1 mark)**

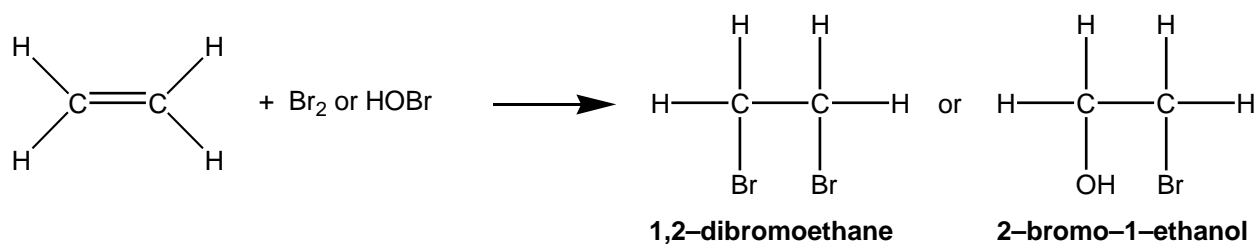
Emission of radioactivity or α or β or γ emission or undergoes radioactive decay.

(c) Identify an instrument that could be used to detect a substance that has unstable nuclei. **(1 mark)**

Geiger counter or Cloud chamber or Bubble chamber

Question 14 (5 marks)

- (a) Give an equation (using structural formulae) for the reaction between ethylene and bromine water and name the organic product. (2 marks)



- (b) (i) Identify the systematic name for styrene. (1 mark)

ethenylbenzene

phenylethene

- (ii) Describe one use for polystyrene and identify a property which makes it useful for this purpose. (2 marks)

Polystyrene can be used for....

- **television backings because of its electrical insulating properties.**
- **disposable cups for hot/cold drinks because of the excellent thermal insulation of PS foam.**
- **lens (magnifying glasses and cheap cameras) because it is transparent and easily moulded.**
- **CD cases and model aircraft, etc. because it can be precisely and easily moulded by injection.**

(1 mark for use. 1 marks for property.)

Question 15 (3 marks)

Complete the table for either a dry cell or lead–acid cell...

	TYPE OF CELL Dry cell <u>or</u> Lead–acid cell (circle your choice above)
Identify the composition of the anode	Dry cell's anode is zinc. Lead–acid cell's anode is lead.
Write the reduction half–equation	Dry cell – $\text{NH}_4^+ + \text{MnO}_2 + \text{H}_2\text{O} + \text{e}^- \rightarrow \text{Mn(OH)}_3 + \text{NH}_3$ Dry cell – $2\text{NH}_4^+ + 2\text{MnO}_2 + 2\text{e}^- \rightarrow \text{Mn}_2\text{O}_3 + 2\text{NH}_3 + \text{H}_2\text{O}$ Lead–acid – $\text{PbO}_2 + \text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^- \rightarrow \text{PbSO}_4 + 2\text{H}_2\text{O}$
<u>One</u> advantage of the cell	Dry cell is inexpensive; can be safely disposed when 'dead'. Lead–acid cell provides high current output; reliable; relatively inexpensive; rechargeable.