ANSWERS and MARKING SCHEME

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 5 minutes for this part

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

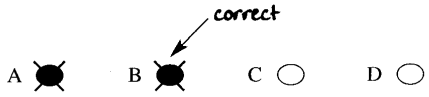
Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

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.



Answer Box for Questions 1–10				
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 ○

► **Mark your answers for Questions 1 – 10 in the Answer Box on page 1.**

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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.
(B) It becomes a mixed polymer.
(C) Only one product is formed in the reaction.
(D) One product must always be water.

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.
(C) Ethanol has a CH_3CH_2 chain which helps it form covalent bonds with non–polar substances.
(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
(D) sucrose

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
(B) 4.4 g
(C) 4.6 g
(D) 9.2 g

6 How can ethylene be obtained from crude oil?

(A) By separating out the lighter components by fractional distillation.
(B) By separating out the heavier components by fractional distillation.
(C) By catalytic cracking of the crude oil followed by distillation.
(D) By decomposing the crude oil followed by distillation.

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

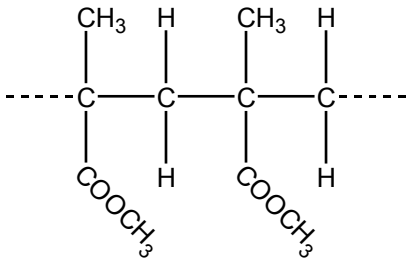
8 Which list shows the metals in order of increasing activity according to the standard potentials data?

(A) Ag, Fe, Cu, Ni
(B) Fe, Al, Mn, Ca
(C) Pb, Fe, Ca, Na
(D) Cu, Mn, Na, Ba

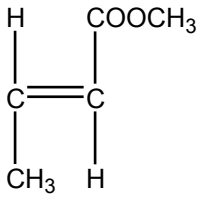
9 In which species is manganese in the lowest oxidation state?

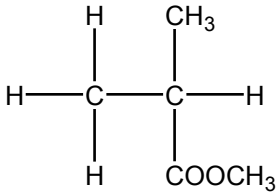
(A) MnO_4^{2-}
(B) MnO_4^{-}
(C) MnO
(D) Mn_2O_3

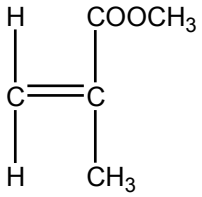
10 A polymer used in the manufacture of artificial eyes has the structure…

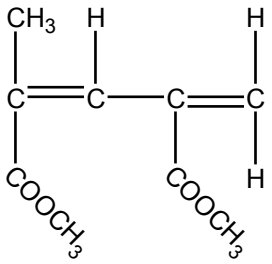


Which of the following chemicals is the monomer for this polymer?

(A) 

(B) 

(C) 

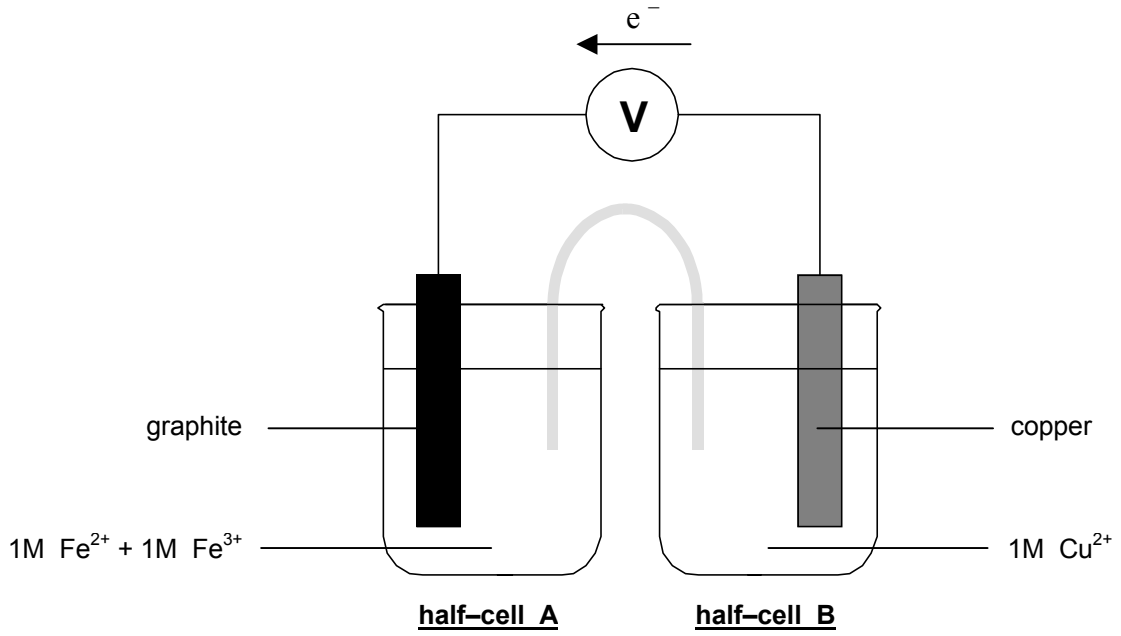
(D) 

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… $Fe^{3+}_{(aq)} + e^- \rightarrow Fe^{2+}_{(aq)}$

(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)

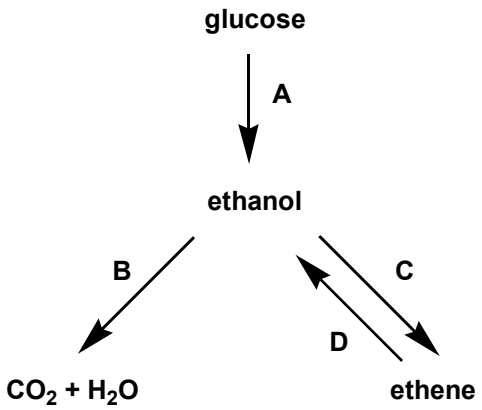
The blue colour of the Cu^{2+} electrolyte becomes darker. (1 mark)

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

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

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	$C_6H_{12}O_{6\ (aq)} \xrightarrow{\text{Yeast (zymase)}} 2CO_{2\ (g)} + 2C_2H_5OH_{\ (aq)}$
B	$C_2H_5OH_{\ (l)} + 3O_{2\ (g)} \rightarrow 2CO_{2\ (g)} + 3H_2O_{\ (l\ or\ g)}$
C	$C_2H_5OH_{\ (l)} \xrightarrow{\text{conc. } H_2SO_4 + \text{heat}} C_2H_{4\ (g)} + H_2O_{\ (l\ or\ g)}$
D	$C_2H_{4\ (g)} + H_2O_{\ (g)} \xrightarrow{H_2SO_4 \text{ or } H_3PO_4 + \text{heat}} C_2H_5OH_{\ (l)}$

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)**

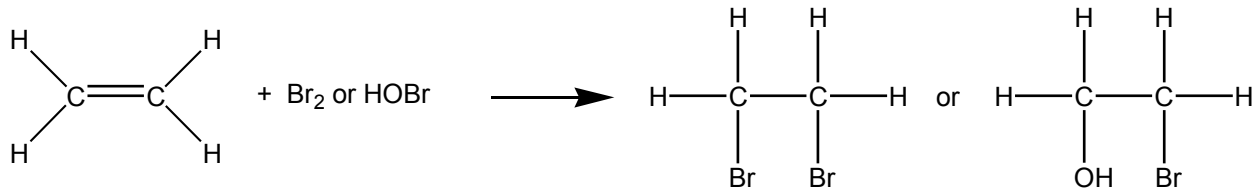
Emission of radioactivity or α or β or γ emission or undergoes radioactive decay.

(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)**



1,2–dibromoethane **2–bromo–1–ethanol**

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

ethenylbenzene

phenylethene

(ii) Describe **<u>one</u>** 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 or 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 – $NH_4^+ + MnO_2 + H_2O + e^- \rightarrow Mn(OH)_3 + NH_3$** **Dry cell – $2NH_4^+ + 2MnO_2 + 2e^- \rightarrow Mn_2O_3 + 2NH_3 + H_2O$** **Lead–acid – $PbO_2 + SO_4^{2-} + 4H^+ + 2e^- \rightarrow PbSO_4 + 2H_2O$**
One 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.**