Chemistry

HSC Course

Production of Materials

Theory Test • 2005

General Instructions

- Reading time – 5 minutes
- Working time – 50 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 – 36

Part A – 5 marks
- Attempt Questions 1 – 5
- Allow about 5 minutes for this part

Part B – 31 marks
- Attempt Questions 6 – 10
- Allow about 45 minutes for this part

Part A – 5 marks
Attempt Questions 1 – 5
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.

correct

A ✖ B ✖ C ◯ D ◯

Answer Box for Questions 1 – 5

|				
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** ◯

1 Which of the following is the most commercially significant addition polymer*?*

(A) cellulose
(B) polyethylene
(C) vinyl chloride
(D) starch

2 Equal volumes of bromine water were added to individual test tubes of cyclohexane and cyclohexene. Which of the choices in the table would be the likely result after the mixtures were shaken vigorously*?*
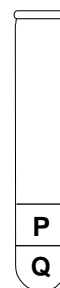
cyclohexane   cyclohexene

	Cyclohexane		Cyclohexene	
	Layer X	*Layer Y*	*Layer P*	*Layer Q*
(A)	colourless water layer	colourless organic layer	orange water layer	colourless organic layer
(B)	colourless water layer	orange organic layer	colourless water layer	colourless organic layer
(C)	darker orange organic layer	lighter orange water layer	colourless organic layer	colourless water layer
(D)	lighter orange organic layer	darker orange water layer	colourless organic layer	colourless water layer

3   What is the oxidation state of chromium in $Na_2Cr_2O_7$?

(A)   2 +
(B)   6 +
(C)   7 +
(D)   12 +

4   The molar heats of combustion of four alkanols are shown in the table…

	$\Delta H_c \ (kJ\ mol^{-1})$
methanol	726
ethanol	1367
2–propanol	2006
2–butanol	2661

Which alkanol produces the greatest amount of heat in kJ g^{-1}?

(A)   methanol
(B)   ethanol
(C)   2–propanol
(D)   2–butanol

5   Which of the following metals would reduce manganese(II) ions in aqueous solution?

(A)   magnesium
(B)   zinc
(C)   copper
(D)   silver

Part B – 31 marks
Attempt Questions 6 – 10
Allow about 45 minutes for this part

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

Question 6   (3 marks)

The production of low density polyethylene from ethylene involves three major steps.

Outline the steps using relevant equations and structural formulae.

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Question 7   (10 marks)

(a)   Traditional sources of petrochemicals are non-renewable and will run-out in the future. Alternative sources have been identified, such as cellulose.

Describe the structure of cellulose.   **(2 marks)**

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(b)   Biopolymers are being developed for commercial use.

(i)   Identify one such biopolymer.   **(1 mark)**

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(ii)   Name the specific enzyme or organism used to synthesize the identified biopolymer.   **(1 mark)**

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(iii)   Describe a use for the identified biopolymer and relate it to its properties.   **(2 marks)**

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(c)   Discuss the use of ethanol as a solvent.   **(4 marks)**

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Question 8   (6 marks)

Heidi performs a determination of the heat of combustion for ethanol using a simple calorimeter containing 300 mL of water. She takes water temperature and fuel mass readings every two minutes using a data logger. The graphs show her complete logged data set (14 readings)…
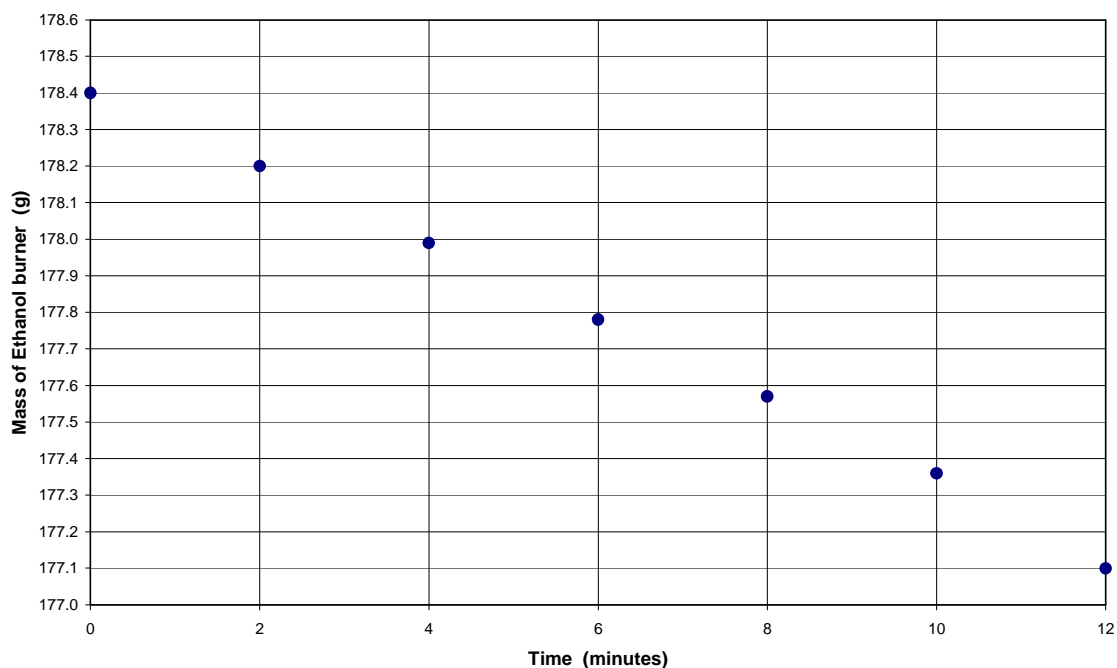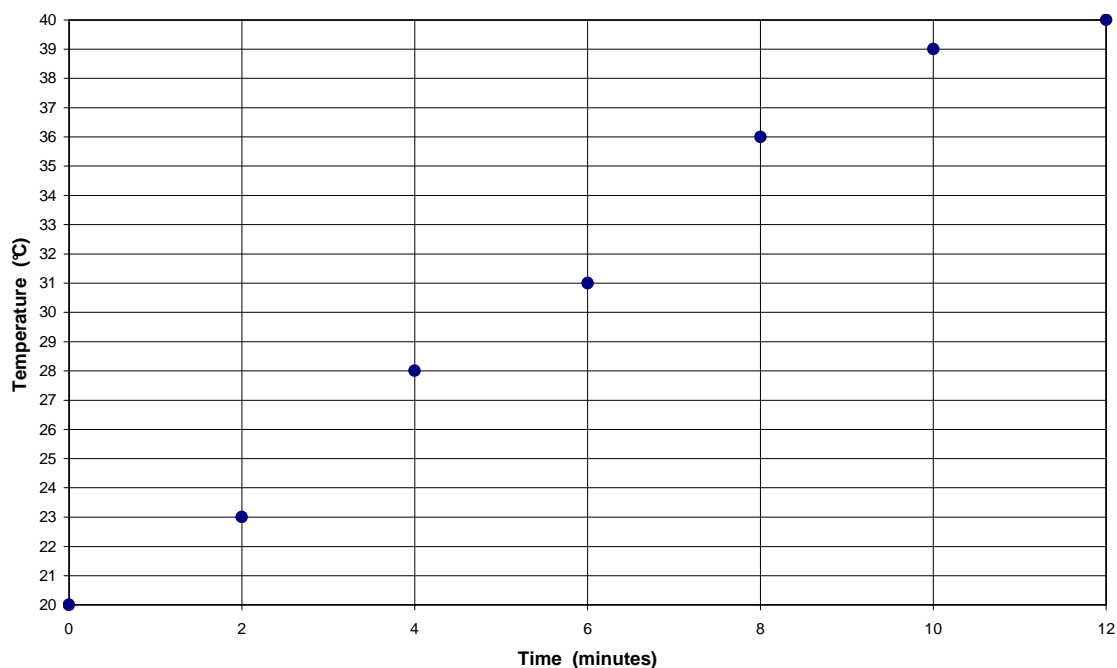
Question 8 continues on page 8

(a) (i) Draw a line of best fit on the time/temperature graph. **(1 mark)**
► *Use pencil.*

(ii) Calculate the molar heat of combustion of ethanol using the graphic data. **(3 marks)**

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(b) Derek Dunceford sets up a heat of combustion apparatus pictured on the right. His chemistry teacher, Mr. Chemiski spots several errors that Derek has made and suggests several improvements.

(i) Identify an error in the way the equipment was set-up. **(1 mark)**

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(ii) Identify an improvement to the experimental design which would produce a better result. **(1 mark)**

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Question 9 (6 marks)

(a) Construct a flow chart to present information clearly and succinctly and show relationships in the production of fuel and plastic from biomass. You should use all nine terms in the list below…
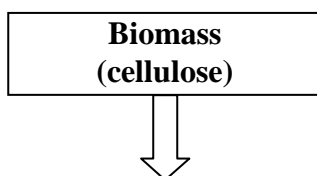(► *They are not in any particular order.*) **(4 marks)**

ethylene	dehydration	glucose	polyethylene	ethanol
fermentation	$CO_2 + H_2O$		combustion	polymerisation

<div align="center">

Biomass (cellulose)

⇩

</div>

(b) (i) Construct a balanced equation for the fermentation of glucose to ethanol. **(1 mark)**

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(ii) Calculate the mass of ethanol produced if there was complete conversion of a 300 mL, 10% (w/v) glucose solution to ethanol. **(1 mark)**

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Question 10 (6 marks)

A student constructed a galvanic cell using silver, silver nitrate, nickel and nickel(II) nitrate.

(a)   Draw a diagram of this galvanic cell and label…   **(3 marks)**

- composition and location of anode and cathode
- direction and location of electron flow
- direction and location of anion and cation flow

(b)   Construct half–equations and the net ionic equation for the cell above.
       Calculate the cell potential.   **(3 marks)**

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