

James Ruse Agricultural High School

Student Number.....

Mark

**Chemistry Assessment
Task 1 Term 4 2007**

Theory

A N S W E R S a n d M A R K I N G S C H E M E s

Chemistry

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 the paper.
- Write your Student Number at the top of this page

Total Marks 37

Part A

Multiple Choice: 10 marks

Attempt Questions 1-10

Allow about 10 minutes for this part

Total Marks 10

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.

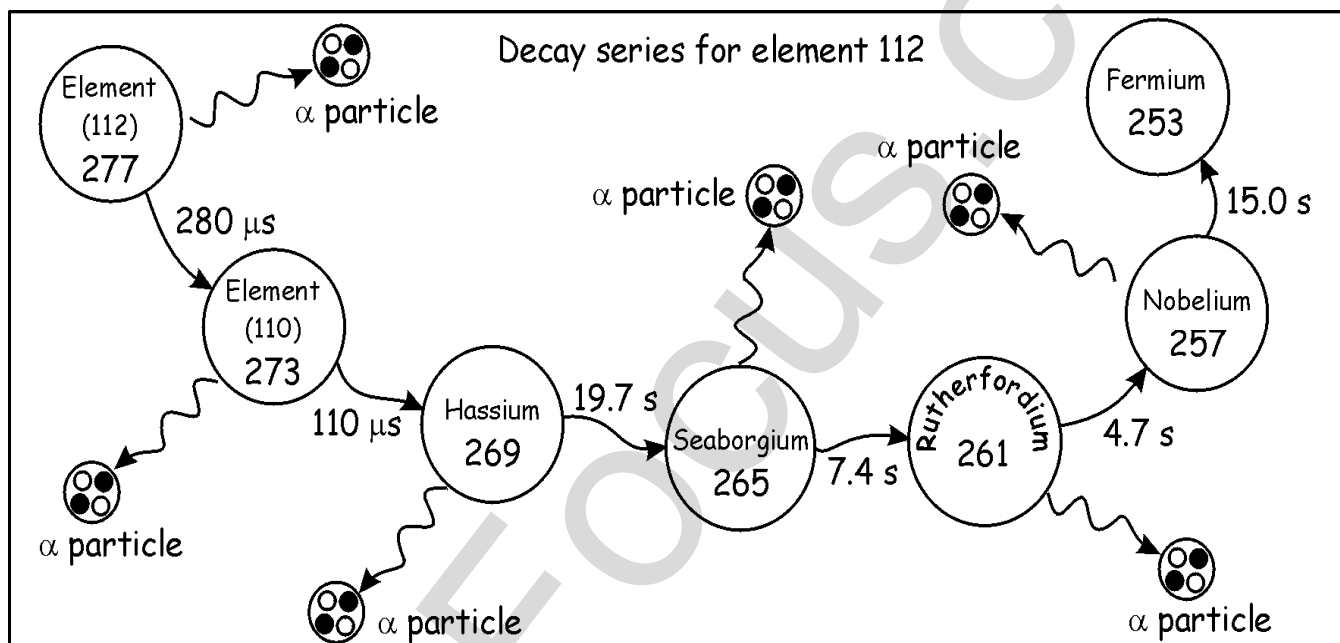
A ☒ B ☒ C ☐ D ☐
correct

► **Mark your answers for Questions 1 – 10 in the Answer Box on page 6**

1. Gold exists in 35 isotopic forms. Stable isotopes of gold have a neutron to proton ratio of 1.5 to 1.
Which of these gold isotopes is stable?

(A) Au-171
(B) Au-205
(C) Au-184
(D) **Au-197**

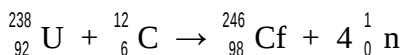
- 2 The diagram shows the progressive decay of element 112.



How long does it take an atom of element 112 to decay into an atom of fermium-253?

- (A) 15.0 seconds
(B) 27.1 seconds
(C) **46.8 seconds**
(D) 436.8 seconds
3. Which addition polymer is used to make a disposable plastic shopping bag?
- (A) cellulose
(B) **polyethylene**
(C) polystyrene
(D) polyvinylchloride

4. Californium-246 is prepared by bombarding a target of uranium-238 with carbon.



Where must the bombardment occur?

- (A) A catalytic cracker
(B) A cloud chamber
(C) A nuclear reactor
(D) **A particle accelerator**
5. The reaction sequence below shows how a monomer can be derived from cellulose in order to build a polymer



Identify X, Y and Z.

	X	Y	Z
(A)	Glucose	Ethene	ethanol
(B)	Ethanol	Glucose	ethene
(C)	Glucose	Ethanol	ethene
(D)	Ethene	Ethanol	glucose

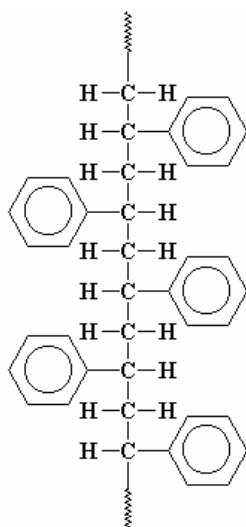
6. What is the major component of biomass?

- (A) **cellulose**
(B) crude oil
(C) ethylene
(D) glucose

7. What are two examples of biopolymers?

- (A) cellulose, glucose
(B) **starch, cellulose**
(C) ethanol, ethylene
(D) petroleum, natural gas

8. A section of a polymer is represented by the following structural formula.



What is the systematic name of the monomer that forms this polymer?

- (A) benzene
(B) ethylbenzene
(C) phenylbenzene
(D) **phenylethene**
9. What name is given for the chemical process that involves the breaking of large carbon compounds found in petroleum into molecules such as propene?
- (A) catalysis
(B) **cracking**
(C) distillation
(D) fractional distillation
10. What is the oxidation state of iodine in NaIO₄?
- (A) 1 -
(B) 3 +
(C) 4 +
(D) **7 +**

Student Number

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Part A Answer grid for multiple choice questions.

Total/ 10

-
- | | | | | |
|-----|-----|-----|-----|-----|
| 1. | A O | B O | C O | D ● |
| 2. | A O | B O | C ● | D O |
| 3. | A O | B ● | C O | D O |
| 4. | A O | B O | C O | D ● |
| 5. | A O | B O | C ● | D O |
| 6. | A ● | B O | C O | D O |
| 7. | A O | B ● | C O | D O |
| 8. | A O | B O | C O | D ● |
| 9. | A O | B ● | C O | D O |
| 10. | A O | B O | C O | D ● |

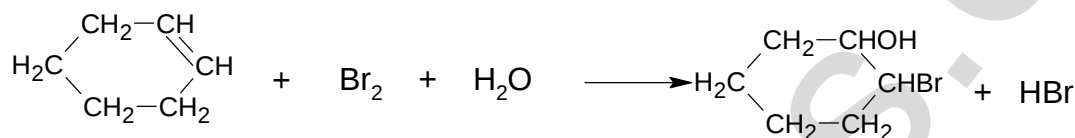
Part B : Extended Response Questions
Allow about 35 minutes for this part.

Question 11 (4 marks)

Describe a chemical procedure that can be used to distinguish between cyclohexane and cyclohexene. Include observations and relevant equation(s).

Possible Answer:

Add equal amounts of cyclohexane and cyclohexene to test tubes; place these in a dark cupboard. Add bromine water. The cyclohexene will react with the bromine water causing it to change from a red/brown colour to colourless (decolourise bromine water). The cyclohexane will not react with the bromine water leaving it a red/brown colour.



Marking Scheme

Criteria	Marks
Description of two expected sets of results (observations*) + stating the use of bromine water + writing a balanced equation	4
Description of two expected sets of results (observations*) + stating the use of bromine water	3
Description of one expected set of results (observations*) + stating the use of bromine water	2
Stating the use of bromine water	1

Note: *observations must describe the relevant colour change observed.

Question 12 (3 marks)

Using an example, outline the steps in the formation of an addition polymer.

Marking Schemes

Criteria	Marks
<i>Description of how a monomer can be activated (initiation) + stating the name of an addition polymer + description of the propagation process</i>	3
<i>Description of how a monomer can be activated (initiation) + stating the name of an addition polymer</i>	2
<i>Stating the name of an addition polymer</i>	1

Possible Answer:

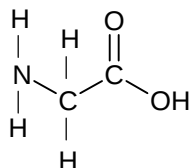
Initiation: radical (or catalyst) is mixed with monomer (ethene). This activates the ethene (breaking the double bond), which then reacts with another ethene (propagation). The process is repeated until a terminator ceases the polyethylene chain growth.

Question 13 (4 marks)

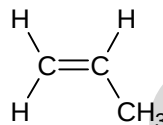
- (a) Draw the structure of a section of an addition polymer and a condensation polymer that can be made from the monomers below. Include 3 monomer units for each polymer. (4 marks)

Monomers:

an amino acid



an alkene



Addition

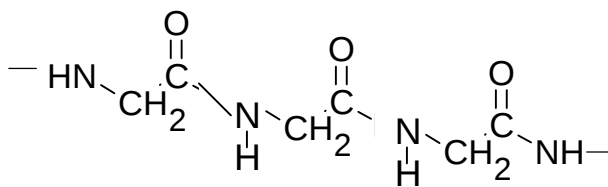
Condensation

- (b) What is the name of the addition polymer? (1 mark)

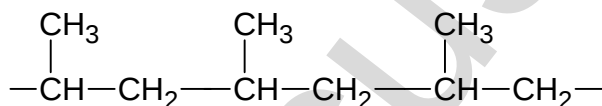
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Possible Answer :

Outcomes: H12, H13, H14



polyglycine



polypropylene

Marking Guidelines

Criteria	Mark
correct structure for addition polymer	1
correct structure for condensation polymer	1
3 monomer units for each polymer	2

(b) What is the name of the addition polymer? (1 mark)

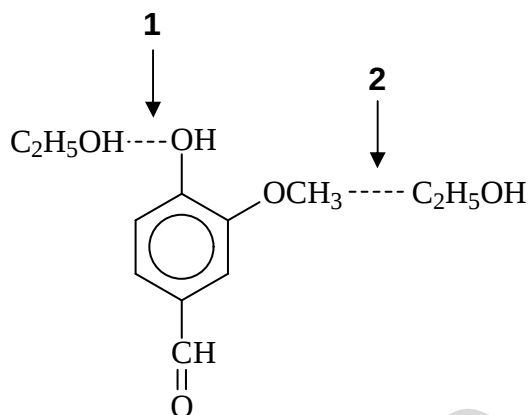
Answer: (polypropene or polypropylene)

Marking Guidelines

Criteria	Mark
correct name	1

Question 14 (2 marks)

A major use of ethanol is as a solvent in the perfume industry. Vanillin (an extract from vanilla) is component of *Vanilla Sky* perfume. The diagram below shows ethanol molecules dissolving vanillin.



Identify the intermolecular forces and the type (polar or non-polar) of solvent behaviour acting at locations 1 & 2.

Location 1

Location 2

ANSWER

At location 1, ethanol is acting as a polar solvent dissolving vanillin by forming a hydrogen bond or dipole-dipole force. (1 mark)

At location 2, ethanol is acting as a non-polar solvent dissolving vanillin with a dispersion force. (1 mark)

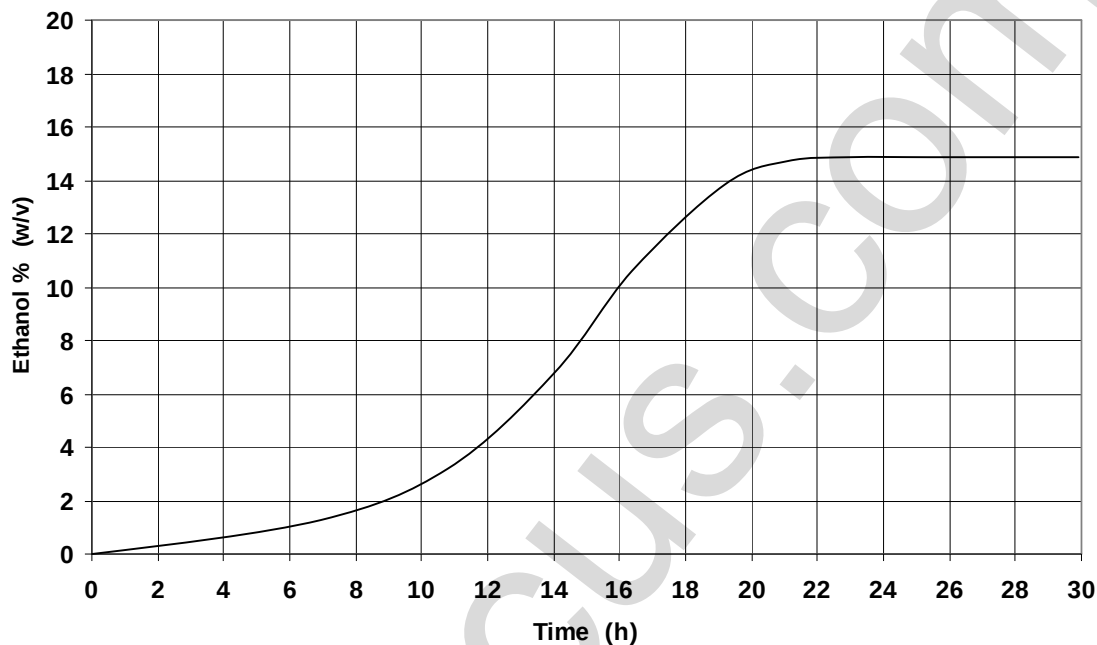
Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
- Identifies intermolecular forces at both locations - Identifies type of solvent behaviour at both locations	2
- Identifies intermolecular forces at both locations OR - Identifies type of solvent behaviour at both locations OR - Identifies intermolecular force and type of solvent behaviour at one location	1

Question 15 (4 marks)

Ethan is conducting research on the effect of temperature on the fermentation of glucose. The graph shows the production of ethanol at a constant temperature of 25°C.



- (a) Calculate the concentration of the ethanol (mol L^{-1}) at 16 hours. **(2 marks)**

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At 16 hours, $[\text{ethanol}] = 10\% \text{ (w/v)} = 10 \text{ g/100 mL}$ (1 mark)

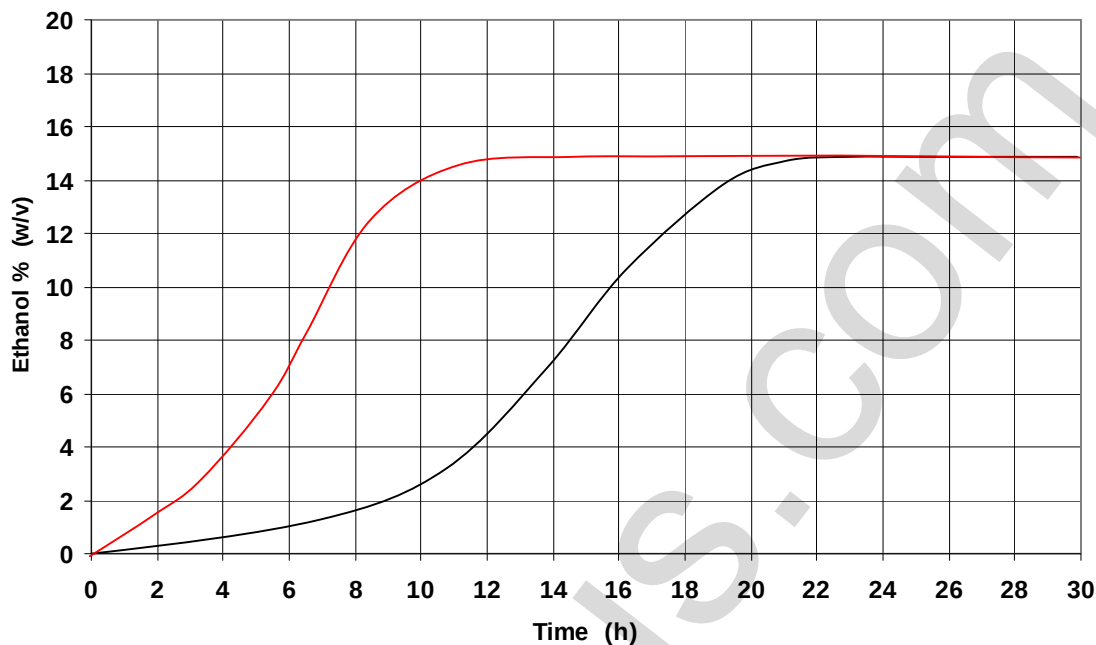
$cV = m/M$; $c = m/M/V = 10 \text{ g}/46.068 \text{ g mol}^{-1}/0.100 \text{ L} = 2.2 \text{ mol L}^{-1}$ (1 mark)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates the concentration of ethanol	2
• Shows one correct step in the calculation	1

- (b) Draw another curve on the graph above, showing the relative production of ethanol if the fermentation had been performed for 30 hours at 35°C instead of 25°C. (2 marks)



Curve with a steeper initial slope (faster fermentation due to more favourable conditions). (1 mark)

Curve plateaus at 15% ethanol where yeast die. (1 mark)

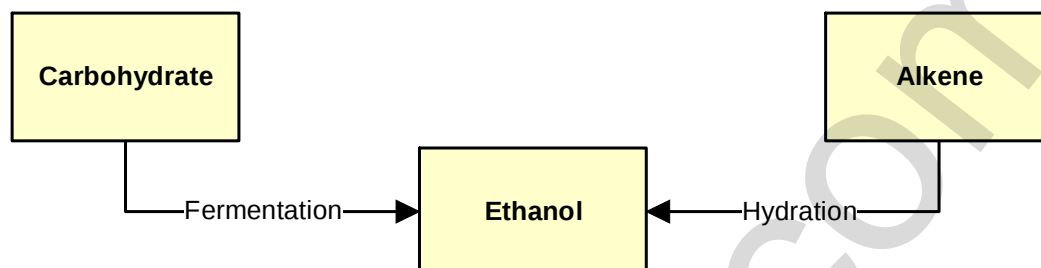
Outcomes assessed: H8, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly draws the curve	2
• Draws a curve with a steeper gradient	1
OR	
• Draws a curve with the same plateau	

Question 16 (5 marks)

Ethanol is globally produced on a large-scale by two main processes as shown on the flow chart.



- (a) Write balanced chemical equations for the two processes including reaction conditions.

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(2 marks)



Conditions – yeast (fermentation), dil. H_2SO_4 (hydration) (1 mark for both)

Question 16 (a)

Outcomes assessed: H8, H9

MARKING GUIDELINES

Criteria	Marks
- Writes two correctly balanced chemical equations and represents ethanol as C_2H_5OH - Identifies the reaction conditions for both reactions	3
Writes two correctly balanced chemical equations and represents ethanol as C_2H_5OH	2
- Writes one correctly balanced chemical equation and represents ethanol as C_2H_5OH OR - Identifies the reaction conditions for both reactions	1

- (b) Australia has a high potential for expanded ethanol production by fermentation. Identify two advantages and two disadvantages of ethanol as a fuel. **(2 marks)**

<i>Advantages</i>	<i>Disadvantages</i>

Possible Answer

Advantages	Disadvantages
• <i>Ethanol is a renewable resource</i> • <i>Ethanol reduces dependence on oil</i> • <i>Ethanol is cleaner burning</i> • <i>Ethanol has lower greenhouse potential</i>	• <i>Ethanol produces less energy than petrol</i> • <i>Ethanol production would require huge tracts of land which could impact on food production</i> • <i>Ethanol is more costly to produce</i>

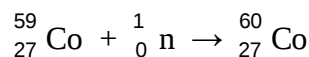
Outcomes assessed: H3, H5

MARKING GUIDELINES

Criteria	Marks
• Identifies two advantages of ethanol as a fuel • Identifies two disadvantages of ethanol as a fuel	2
• Identifies two advantages of ethanol as a fuel OR • Identifies two disadvantages of ethanol as a fuel OR • Identifies one advantage and one disadvantage of ethanol as a fuel	1

Question 17 (4 marks)

Cobalt-60 is a radioisotope used in medicine and industry and is prepared by a simple nuclear reaction...



- (a) Where does this process take place? (1 mark)

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Nuclear reactor

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Identifies the process taking place in a nuclear reactor	1

- (b) All radioisotopes must be used with extreme caution.

- (i) Outline the danger associated with radioisotopes. (2 marks)

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Outcomes assessed: H4

MARKING GUIDELINES

Criteria	Marks
• Identifies radiation or radioactivity as a danger • Identifies a specific harmful effect of radiation or radioactivity	2
• Identifies radiation or radioactivity as a danger OR • Identifies a specific harmful effect of radiation or radioactivity	1

Radiation/radioactivity (1 mark) causes damage/death to living cells (1 mark).

- (c) (ii) Identify an instrument which can be used to detect the danger. **(1 mark)**

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Geiger counter

Outcomes assessed: H4

MARKING GUIDELINES

Criteria	Marks
• Identifies an instrument used to detect radiation or radioactivity	1