

Student No.



Barker College

2007
YEAR 12
EXAMINATION
TERM 1

Chemistry

ANSWER SHEET

Staff Involved:

AM MONDAY 26 MARCH

- RJP*
- RZS
- JFH

95 copies

Section I – Multiple Choice

Choose the best response and fill in the response oval completely

1.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
2.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
3.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
4.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
5.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
6.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
7.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
8.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
9.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
10.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
11.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
12.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
13.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
14.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
15.	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D



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General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using blue or black pen
- Board-approved calculators may be used
- Draw diagrams using pencil
- A Data Sheet and Periodic Table are provided at the back of this paper
- Write your Barker Student Number at the top of the Answer Sheet and Cover Sheet and ALL pages in Section II

Total marks (80)

Section I

Pages – 2 5

15 marks

- Indicate all answers on the Answer Sheet provided
- Allow about 25 minutes for this section

Section II

Pages 6 – 18

65 marks

- Attempt ALL questions
- Indicate all answers in the spaces provided on the Answer Sheets
- Show all working for this section
- Allow about $1\frac{1}{2}$ hours this section

Section I

15 marks

Allow about 25 minutes for this section

Attempt ALL questions

Use the multiple-choice answer sheet

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.

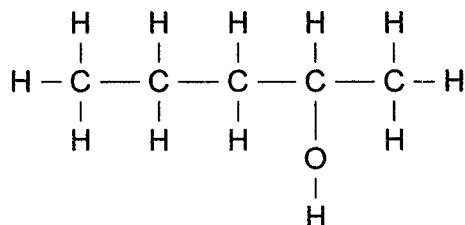
(A) ☒ (B) ☒ (C) ☐ (D) ☐

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows.

(A) ☒ (B) ☒ (C) ☐ (D) ☐

correct
↖

- Which of the following processes is used to convert some fractions from the refining of petroleum into ethylene?
 - polymerisation
 - fermentation
 - dehydration
 - catalytic cracking
- What is the term used to describe the conversion of ethanol into ethylene?
 - condensation
 - hydrogenation
 - addition
 - dehydration
- What is the name of the compound represented below?



- 2-butanol
 - 4-pentanol
 - pentan-4-ol
 - 2-pentanol
- Polystyrene is an example of an addition polymer. What is the common name and the systematic name for the monomer from which this polymer is formed?
 - common name: styrene, systematic name: phenylethene
 - common name: phenylethene, systematic name: styrene
 - common name: ethenyl benzene, systematic name: styrene
 - common name: vinyl chloride, systematic name 2-dichloroethene
 - Which of the following is a monomer of cellulose?
 - ethylene
 - glucose
 - starch
 - galactose

6. What is the oxidation state (number) of Mn in MnO_4^- ?

- (A) +1
- (B) +2
- (C) -7
- (D) +7

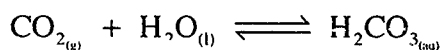
7. The reaction that goes in the direction shown is:

- (A) $Mg^{2+}_{(aq)} + Fe_{(s)} \rightarrow Mg_{(s)} + Fe^{2+}_{(aq)}$
- (B) $Zn_{(s)} + Pb^{2+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + Pb_{(s)}$
- (C) $Pb_{(s)} + Fe^{2+}_{(aq)} \rightarrow Pb^{2+}_{(aq)} + Fe_{(s)}$
- (D) $2Ag_{(s)} + Sn^{2+}_{(aq)} \rightarrow 2Ag^+_{(aq)} + Sn_{(s)}$

8. Iron-58 is bombarded with neutrons in a nuclear fission reactor. A single neutron is captured by the Fe-58 nucleus to form a new isotope of iron? This isotope then undergoes beta decay, producing a daughter nucleus. What is the identity of the daughter nucleus?

- (A) $^{59}_{27}Co$
- (B) $^{59}_{26}Fe$
- (C) $^{57}_{26}Fe$
- (D) $^{59}_{25}Fe$

9. Consider the following reaction (the forward reaction is exothermic):



Which of the following changes to equilibrium conditions would favour the formation of bubbles of carbon dioxide?

- (A) increasing the pressure
- (B) increasing the temperature
- (C) decreasing the temperature
- (D) addition of water

10. What is the pH of orange juice closest to?

- (A) 6.5
- (B) 1.5
- (C) 7.5
- (D) 3.5

11. A nitric acid solution had a pH of 2. 10mL of the solution was diluted to 100mL. What is the pH of the final solution closest to?
- (A) 0.2
(B) 2.5
(C) 1.0
(D) 3.0
12. Which one of the following statements concerning equimolar (equal concentrations) solutions of a strong monoprotic acid (HA) and a weak monoprotic acid (HB) is **incorrect**?
- (A) HA has a higher pH than HB.
(B) The concentration of A^- is greater than the concentration of B^- .
(C) The degree of ionization is greatest in HA.
(D) HA has a lower pH than HB.
13. Which of the following is the conjugate base of HSO_4^- ?
- (A) SO_4^{2-}
(B) H_2SO_4
(C) HSO_3^-
(D) H_2SO_3
14. Which of the substances below could be classified as an Arrhenius base?
- (A) water
(B) potassium hydroxide
(C) sodium carbonate
(D) calcium oxide
15. Which of the following groups of carbon compounds is listed in order of increasing solubility in water?
- (A) acetic acid, octanoic acid, ethanol, ethane
(B) ethane, octanoic acid, ethanol, acetic acid
(C) acetic acid, ethanol, octanoic acid, ethane
(D) ethane, ethanol, octanoic acid, acetic acid

Section II**65 marks****Attempt ALL questions****Allow about $1\frac{1}{2}$ hours for this section**

Use the spaces provided on the paper.

Marks**Question 16 (5 marks)**

A student is given two test tubes during a practical lesson. He is told that one test tube contains cyclohexane while the other contains cyclohexene.

- (a) What chemical should the student use to identify which test tube contains the cyclohexane and which test tube the cyclohexene?

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- (b) The student adds one mL of the reagent mentioned in (a) to each of the test tubes and shakes the tubes. Write down the immediate observations made by the student.

2

Cyclohexane:

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Cyclohexene:

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- (c) Draw structural formulae to show the reaction of cyclohexane with the reagent mentioned in (a) (assuming the reaction was allowed to take place exposed to light (uv) and left for some time).

2

Student No.

Marks

Question 17 (5 marks)

Vinyl chloride has the condensed formula CH_2CHCl .

- (a) What is the systematic name for this compound?

1

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- (b) Draw a diagram using structural formulae to show the formation of a section of poly (vinyl chloride). Show at least three monomer units.

2

- (c) Give ONE use for PVC, explaining the properties which make it suitable for this purpose.

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Question 18 (5 marks)

An experiment was performed to determine the Heats of Combustion of two alkanols. The amount of fuel required to heat 200 mL of water by approximately 10 degrees was measured. The following results were obtained.

	1-butanol	1-pentanol
initial mass of burner (g)	25.25	28.42
final mass of burner (g)	24.96	28.24
initial temperature of water (°C)	22.5	22.0
final temperature of water (°C)	33.0	35.0

- (a) Calculate the Molar Heat of Combustion for 1-butanol using the data given and your data sheet. (Density of water is 1.0 g mL^{-1})

3

- (b) The theoretical value for the Molar Heat of Combustion for 1-butanol is 2677 kJ mol^{-1} . Discuss the reasons for any discrepancy from your result calculated in part (a).

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Question 20 (6 marks)

- (a) Write an equation for the fermentation of glucose $C_6H_{12}O_6$. 1

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- (b) Name TWO conditions under which fermentation is promoted. 1

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- (c) Identify a factor which causes the fermentation process to cease after a few days. 1

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- (d) Outline an investigation you carried out in the laboratory to monitor the process of fermentation of glucose. 3

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Question 21 (6 marks)

In the laboratory you have conducted an experiment to measure the voltage of an electrochemical cell that you set up. One of the combinations you used was a lead electrode in a lead (II) nitrate solution connected to a zinc electrode in a zinc nitrate solution.

- (a) Draw a neat, **labelled** diagram of the experimental setup showing the direction of electron flow in the external circuit as well as the movement of ions in the salt bridge.

3

- (b) oxidation half equation:

reduction half equation:

1

- (c) Calculate the EMF of the cell and comment on why the voltage you obtained in the lab when doing this experiment was lower than the theoretical EMF for the cell.

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Question 23 (11 marks)

Sulfur was burnt in a gas jar of oxygen. There was enough oxygen for all the sulfur to react. The product of this reaction was dissolved in water and tested with phenolphthalein. The indicator remained colourless.

- (a) Is the solution acidic or basic?

1

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- (b) Write a balanced chemical equation for the reaction involving the burning of sulfur, including states.

1

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- (c) Identify ONE natural and ONE industrial source of sulfur dioxide.

Natural source:

Industrial source:

2

Question 23 continues on page 14

Question 23 (continued)

- (d) Discuss reasons for concern about the release into the environment of oxides of sulfur and nitrogen. Include relevant equations.

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Question 23 continues on page 15

Question 23 (continued)

- (e) If 22.00 g of sulfur were burned, calculate the volume of gas produced at 0°C and 100 kPa.

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Question 24 (3 marks)

- (a) Define Le Chatelier's Principle.

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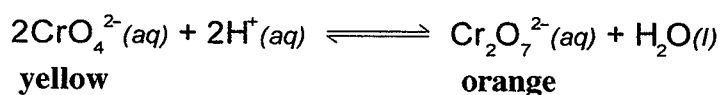
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- (b) Use Le Chatelier's Principle to explain what will happen to the following reaction at equilibrium when sodium hydroxide solution was added to the system. State any colour changes.

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Student No.

Marks

Question 25 (5 marks)

Describe an experiment you have performed to measure the pH of a range of salt solutions. Mention the precautions you took to ensure the accuracy of your results.
For TWO of the salts used explain, using equations, why their pHs were not 7.

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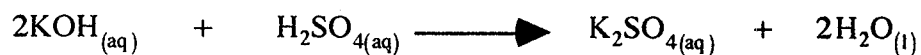
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Question 26 (5 marks)**Show ALL working.**

The equation for the reaction between potassium hydroxide and sulfuric acid is



A chemist carries out a titration to find the concentration of a sulfuric acid solution. In the titration, the acid is in the burette. These are the details of the titration:

- concentration of potassium hydroxide solution: $0.0671 \text{ mol L}^{-1}$
- volume of potassium hydroxide solution used in each titration: 20.0 mL
- average volume of sulfuric acid used to just react with the base: 27.5 mL

(a) Calculate the number of moles of KOH used in each titration. 1

(b) Calculate the concentration of the sulfuric acid solution in mol L^{-1} 2

(c) Outline TWO possible sources of error when carrying out a titration 2

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Question 27 (5 marks)

Esters are fruity organic compounds made by reacting an alcohol (alkanol) with a carboxylic acid (alkanoic acid).

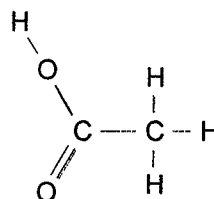
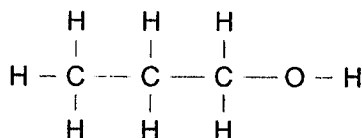
- (a) Describe the purpose of using concentrated acid in esterification and name the acid used.

2

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- (b) Identify the IUPAC nomenclature for describing the ester produced from the following reactants i.e. name the ester produced when the reactants below are refluxed.

1



Name of ester produced:

- (c) Explain the need for refluxing during esterification.

2

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End of Paper

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

$$\text{pH} = -\log_{10}[\text{H}^+]$$

$$\Delta H = -m C \Delta T$$

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		Symbol of element		Name of element					
Atomic Number		Atomic Weight		Atomic Weight					
1	H	1.008	Hydrogen	2	He	4.003	Helium		
3	Li	6.941	Lithium	4	Be	9.012	Beryllium		
11	Na	22.99	Sodium	12	Mg	24.31	Magnesium		
19	K	39.10	Potassium	20	Ca	40.08	Calcium		
37	Rb	85.47	Rubidium	38	Sr	87.62	Strontium		
55	Cs	132.9	Cesium	56	Ba	137.3	Barium		
87	Fr	[223.0]	Francium	88	Ra	[226.0]	Radium		
21	Sc	44.96	Scandium	22	Ti	47.87	Titanium		
23	V	50.94	Vanadium	24	Cr	52.00	Chromium		
25	Mn	54.94	Manganese	26	Fe	55.85	Iron		
27	Co	58.93	Cobalt	28	Ni	58.69	Nickel		
29	Cu	63.55	Copper	30	Zn	65.41	Zinc		
39	Y	88.91	Yttrium	40	Zr	91.22	Zirconium		
41	Nb	92.91	Niobium	42	Mo	95.94	Molybdenum		
43	Tc	[97.91]	Technetium	44	Ru	101.1	Ruthenium		
45	Rh	102.9	Rhodium	46	Pd	106.4	Palladium		
47	Ag	107.9	Silver	48	Cd	112.4	Cadmium		
57-71			Lanthanides	72	Hf	178.5	Hafnium		
73	Ta	180.9	Tantalum	74	W	183.8	Tungsten		
75	Re	186.2	Rhenium	76	Os	190.2	Osmium		
77	Ir	192.2	Iridium	78	Pt	195.1	Platinum		
79	Au	197.0	Gold	80	Hg	200.6	Mercury		
81	Tl	204.4	Thallium	82	Pb	207.2	Lead		
83	Bi	209.0	Bismuth	84	Po	[209.0]	Polonium		
85	At	[210.0]	Astatine	86	Rn	[222.0]	Radon		
87-103			Actinides	104	Rf	[261.1]	Rutherfordium		
105	Ds	[261.1]	Darmstadtium	106	Sg	[266.1]	Seaborgium		
107	Bh	[264.1]	Bohrium	108	Hs	[277]	Hassium		
109	Mt	[268]	Meitnerium	110	Ds	[271]	Darmstadtium		
111	Rg	[272]	Roentgenium	112	Cn	[285]	Ununbium		

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
138.9	140.1	140.9	144.2	[144.9]	150.4	152.0	157.3	158.9	162.5	164.9	167.3	168.9	173.0	175.0
Lanthanum	Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium

89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
Actinium	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lanthanum
[227.0]	232.0	231.0	238.0	[237.0]	[244.1]	[243.1]	[247.1]	[247.1]	[251.1]	[252.1]	[257.1]	[258.1]	[259.1]	[260.1]

20