

CSE – MAY 2009

YEAR 12 CHEMISTRY

Written test 1

ANSWERS & SOLUTIONS BOOK

SECTION A – Multiple choice questions (20 marks)

1	A	5	A	9	B	13	D	17	C
2	D	6	D	10	A	14	D	18	D
3	C	7	A	11	B	15	B	19	B
4	A	8	C	12	C	16	C	20	A

SECTION B – Short answer questions (53 marks)**Question 1 (13 marks)**

a. $\text{CO}_2(\text{g}) + \text{Ba}(\text{OH})_2(\text{aq}) \rightarrow \text{BaCO}_3(\text{s}) + \text{H}_2\text{O}(\text{l})$ 1 mark

b. $\text{Ba}(\text{OH})_2(\text{aq}) + 2\text{HCl}(\text{aq}) \rightarrow \text{BaCl}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$ 1 mark

c. $n(\text{Ba}(\text{OH})_2) = c \times V = 0.108 \times 0.100 = 0.0108 \text{ mol}$ 1 mark

d. $n(\text{HCl}) = c \times V = 0.0968 \times 0.02680 = 2.594 \times 10^{-3} \text{ mol}$ 1 mark

e. $n(\text{Ba}(\text{OH})_2) = \frac{1}{2} n(\text{HCl}) = \frac{1}{2} \times 2.594 \times 10^{-3} = 1.297 \times 10^{-3} \text{ mol}$ 1 mark

f. $n(\text{Ba}(\text{OH})_2)_{\text{reacted}} = 0.0108 - 1.297 \times 10^{-3} = 9.503 \times 10^{-3} \text{ mol}$
 $n(\text{CO}_2) = n(\text{Ba}(\text{OH})_2) = 9.503 \times 10^{-3} \text{ mol in 500 L of air}$ 2 marks

g. $V(\text{CO}_2) = n(\text{CO}_2) \times 24.5 = 0.233 \text{ L at SLC}$ 1 mark

h. $v/v\% = 0.233/500 \times 100 = 0.0466\%$ 1 mark

i. $n(\text{BaCO}_3) = 1.550 / 197.3 = 0.007856 \text{ mol} = n(\text{CO}_2)$
 $n(\text{CO}_2) = n(\text{BaCO}_3) \times 24.5 = 0.007856 \times 24.5 = 0.193 \text{ L}$
 $v/v\% = 0.193 / 500 \times 100 = 0.0385\%$ 3 marks

j. Incomplete precipitation, precipitate loss during washing, precipitate lost during filtration etc
 Allow consequential mark for paper and precipitate not dried to constant mass if i. > h. 1 mark

Question 2 (4 marks)

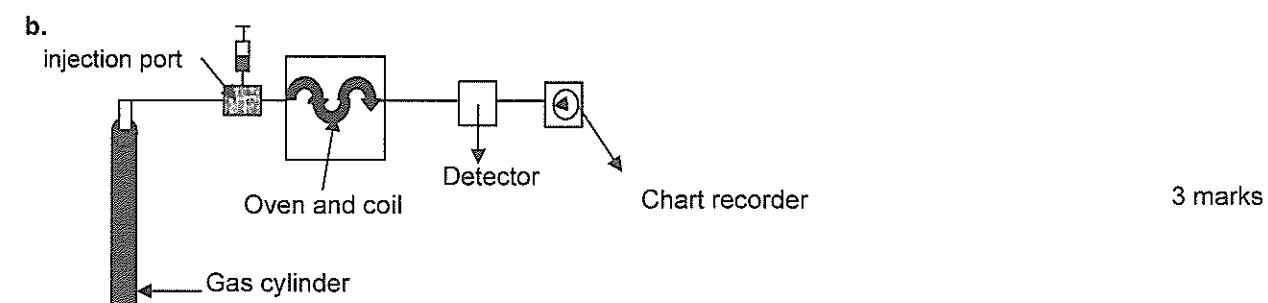
a. $2\text{Li}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{LiOH}(\text{aq}) + \text{H}_2(\text{g})$ 1 mark

b. $n(\text{LiOH}) = 2.50 / 6.9 = 0.362 \text{ mol}$
 $c = n/V = 0.362 / 0.100 = 3.62 \text{ mol L}^{-1}$ 2 marks

c. $g/L = c \times Mr = 3.623 \times 23.9 = 86.6 \text{ g L}^{-1}$ 1 mark

Question 3 (8 marks)

- a. Paper is made of cellulose which is a polymer of glucose. A polar organic molecule with dipole-dipole (and possibly H-bonding) attractions will adsorb to a greater extent to the paper. 1 mark



- c. Methanol will be detected first followed by ethanol and then ethane-1,2-diol. Separation reflects differences in relative molecular mass. 2 marks
- d. Glucose is thermally unstable and will decompose. 1 mark
- e. Operating conditions such as eluent pressure and operating temperature can vary and this will change retention times. 1 mark

Question 4 (7marks)

- a. Peaks due to isotopes such as ^{13}C or ^{18}O or ^2H etc 1 mark
- b. Peak 31 corresponds to fragment CH_2OH^+ 1 mark
- c. Propan-1-ol because of peaks 43 $\text{CH}_3\text{CH}_2\text{CH}_2^+$, 31 CH_2OH^+ etc and no peak at 45 COOH^+ 1 mark
- d. A carbonyl stretch between 1670 and 1750 cm^{-1} and different OH frequency for alcohol compared to carboxylic acid frequency 1 mark
- e. Triplet at about a shift of 1 ppm 2 marks
- f. 3 peaks 1 mark

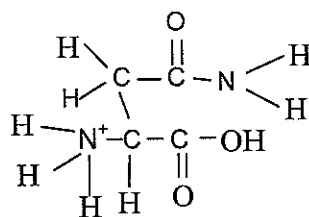
Question 5 (7 marks)

Semi-structural formula of all the reactant(s) needed for the reaction	Semi-structural formula of organic product	Name of organic product	Type of reaction
$\text{CH}_2=\text{CH}_2 + \text{H}_2\text{O}$	$\text{CH}_3\text{CH}_2\text{OH}$	ethanol	addition
$\text{CH}_3\text{CH}_3 + \text{Br}_2 \rightarrow$	$\text{CH}_3\text{CH}_2\text{Br}$ or other	bromoethane or other	substitution
$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{Cr}_2\text{O}_7^{2-}/\text{H}^+ \rightarrow$	$\text{CH}_3\text{CH}_2\text{COOH}$	propanoic acid	oxidation
$\text{CH}_2=\text{CHCl}$	$-(\text{CH}_2\text{CHCl})_n-$	polyvinyl chloride	addition or polymerisation
$\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} + \text{NH}_3 \rightarrow$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$	1-aminopropane	substitution
$\text{CH}_3\text{OH} + \text{HCOOH}$	HCOOCH_3	methyl methanoate	condensation or esterification
$(\text{CH}_3)_2\text{CH}=\text{CH}_2$	$\text{CH}(\text{CH}_3)_3$	2-methylpropane	hydrogenation

1 mark for each line correct

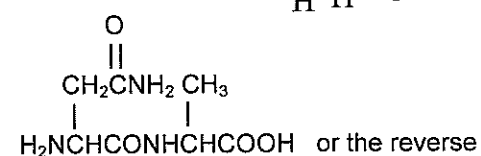
Question 6 (7 marks)

a.



1 mark

b.



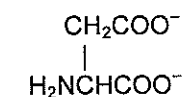
1 mark

c.

Structure	Type(s) of bonding
Primary	Covalent or peptide
Secondary	H-bonding
Tertiary	H-bonding, dipole-dipole, disulfide, ion-dipole etc

3 marks

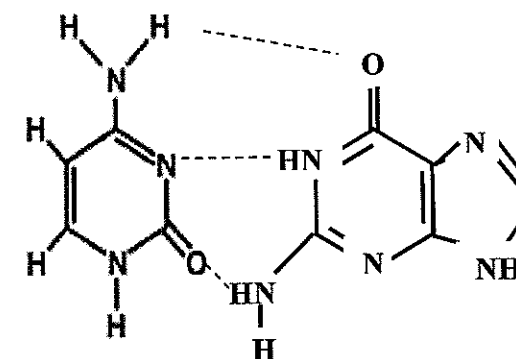
d.



2 marks

Question 7 (7 marks)

a.



2 marks

b.

Strand i



1 mark

c.

Strand ii



Any answer with more than 4 GC base pairs

1 mark

d.

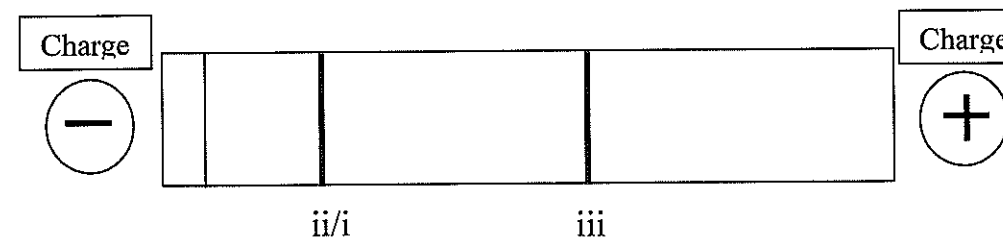
Strand iii



Strand iii must be shorter than strand i.

1 mark

e.



2 marks