

# HKDSE Chemistry Practice Papers Briefing Session

(14 & 18 February 2012)

Mr PAU Chiu Wah  
HKEAA

# Programme Rundown

<b>2:00 – 2:10 / 9:30 – 9:40</b>	<b>Registration</b>
<b>2:10 – 2:30 / 9:40 – 10:00</b>	<b>Question paper requirements of the DSE Chemistry Examination</b>
<b>2:30 – 2:45 / 10:00 – 10:15</b>	<b>Students' performance on multiple-choice questions (Paper 1A)</b>
<b>2:45 – 3:30 / 10:15 – 11:00</b>	<b>Marking scheme interpretation (Paper 2) and students' performance</b>
<b>3:30 – 3:45 / 11:00 – 11:15</b>	<b>Break</b>
<b>3:45 – 4:30 / 11:15 – 12:00</b>	<b>Marking scheme interpretation (Paper 1B) and students' performance</b>
<b>4:30 – 5:00 / 12</b>	<b>Q&amp;A</b>

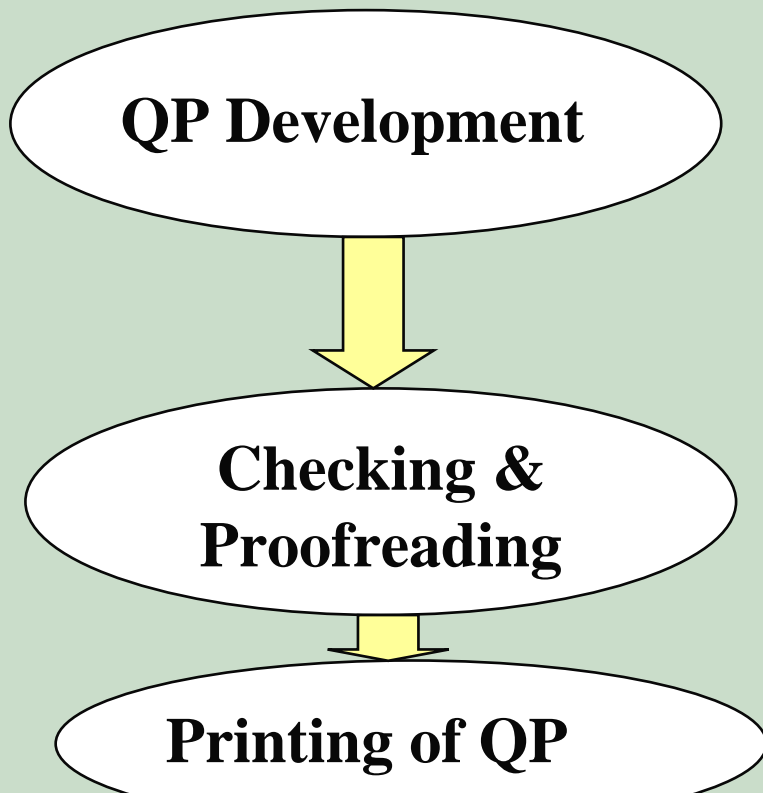
# Acknowledgements

- Members of the Moderation Committee for the Practice Papers
- Schools participated in the piloting (7 schools and more than 300 students involved)
- CDI-HKEAA Committee on NSS Chemistry Education
- All those who has contributed to the successful implementation of HKDSE Chemistry and Combined Science (Chemistry)

# What can practice papers illustrate

- Curriculum emphases
- Question types
- Level of difficulty
- Skills to be tested
- Relationship between Chemistry and Combined Science (Chemistry part)

# Development of Examination Papers (Pre-exam Work)



## Moderation Committee

- Chief Examiner(s)
- Moderators
- Setter(s)
- MC Contributor(s)

- Assessors
- Proofreaders

GLD Printing Unit



# Marking and Grading (Post-exam Work)

## Marking of scripts

- Examiners' Meeting
- Markers' Meeting
- Checkmarking of scripts

## Standards-based Grading

## Appeal of examination results

Rechecking and Reporting



# The Marking Scheme

- Preliminary and 'final' marking schemes
- Suggested answers cannot be exhaustive (professional judgment)
- Symbols used in the marking scheme

## / **Alternative answers**

- **Step-mark**

## † **Correct spelling**

- Number of significant figures expected
- Marking chemical equations

- 



# Structure of DSE Chemistry Examination

Paper	Section	Weighting	Other information
1	A	60%	Part I: 24 MCQs Part II: 12 MCQs
1	B		Part I: 56 marks Part II: 28 marks
2		20%	One question on each of the Elective
SBA		20%	



# Structure of DSE Combined Science (Chem) Examination

Paper	Weighting	Others
Written exam	40%	Section A: 24 MCQs Section B: 56 marks
SBA	10%	

# The Chemistry Practice Papers



# Paper 1 Section A: Multiple-choice Questions

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- Question type
  - Single response type
  - Multiple-completion type
  - Assertion-reason type
- Chemistry and Combined Science (Chem)  
(Q Nos: 15, 16 and 17)

# Students' Performance in Pilot Study

## (Paper 1 Section A)

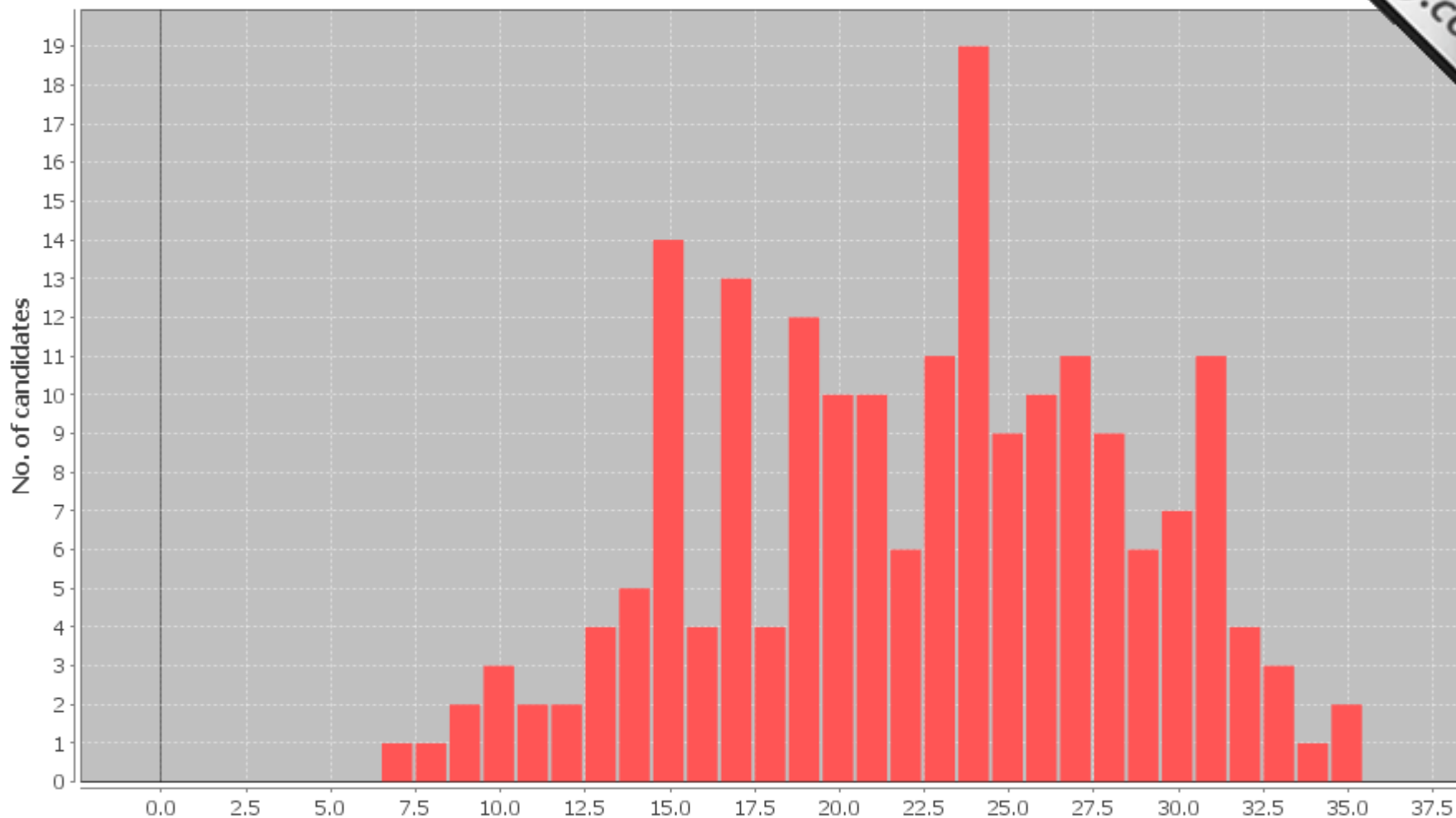
- Number of schools = 5
- No. of participating students = 194
- Mean = 22.2 (61.89%)
- S.D. = 6.18 (17.16%)

Question best attempted: Q.1 (95% correct)

Question worst attempted: Q.7 (31% correct)

# Mark Distribution for Chemistry 1A

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## Q.7 A question on Nature of Science

A scientist extracted a sample of 'nitrogen' from air by removing the oxygen and carbon dioxide. The scientist then compared the mass of a known volume of the 'nitrogen' sample ( $m_1$ ) with that of the same volume of pure nitrogen ( $m_2$ ) under the same set of conditions. The experiment was repeated a number of times. It was found that  $m_1$  was consistently greater than  $m_2$ .

Which of the following gases is likely to be present in the 'nitrogen' obtained to account for the result that  $m_1$  is greater than  $m_2$  ?

- A. neon (17%)                      B. argon (31%)  
C. methane (13%)                  D. water vapour (44%)





# Qs that are different in the Chemistry Combined Science papers (Qs. 15, 16 & 17)

## Chemistry Q.17

Ammonia is very soluble in water. Which of the following statements best accounts for this phenomenon ?

- A. Both ammonia molecule and water molecule are polar.
- B. Ammonia molecule and water molecule are of comparable sizes.
- C. Ammonia undergoes ionisation in water.
- D.\* Ammonia forms hydrogen bond with water.

# Combined Science (Q.16)

Which of the following gases is least soluble in water ?

- A.  $\text{H}_2(\text{g})$
- B.  $\text{O}_2(\text{g})$
- C.  $\text{CO}_2(\text{g})$
- D.  $\text{NH}_3(\text{g})$

# A question on structural isomerism (16)

## *First statement*

The structural formula  $\text{H}_2\text{C}=\text{CF}_2$  can represent two different compounds.

## *Second statement*

The rotation of the  $\text{CF}_2$  group relative to the  $\text{CH}_2$  group in  $\text{H}_2\text{C}=\text{CF}_2$  is restricted by the  $\text{C}=\text{C}$  bond.

Students' response pattern:

**A. 16%**

**B. 11%**



# Conventional Questions

# Skills to be tested in the Chemistry papers

- Understanding of chemical concepts: microscopic and macroscopic properties
- Understanding of the patterns in chemistry
- Appreciation of the relevancy of chemistry to daily life
- Chemistry and sustainable development
- Scientific investigation skills





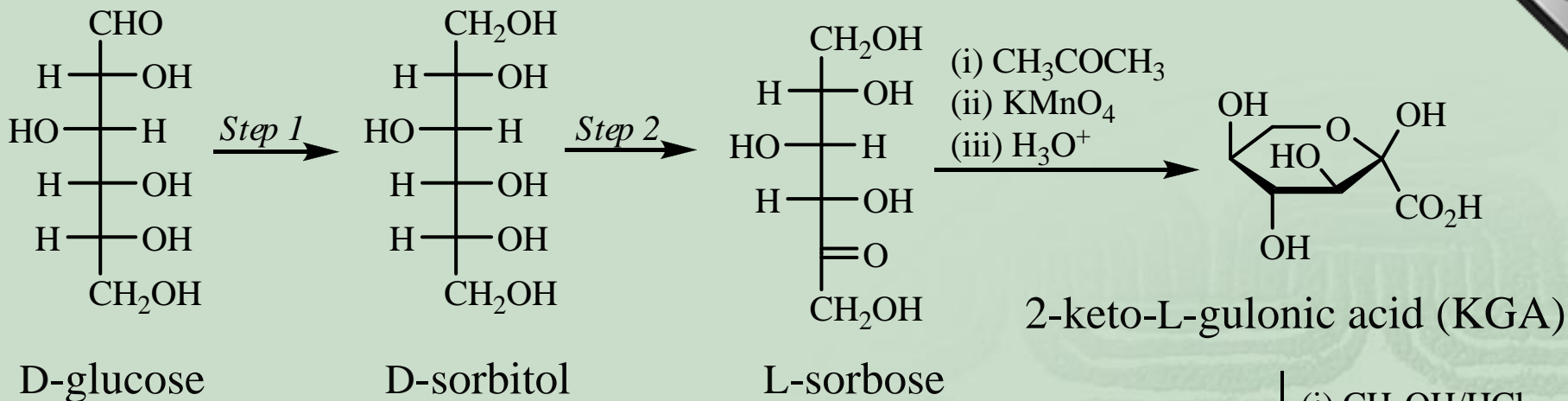
# Question Verbs Used in DSE Chemistry Practice Papers

State / Write	寫出	Suggest	提出 / 建議
Name	寫出..名稱	Explain	解釋
Draw	繪出	Account for	解釋/說明
Sketch	略繪	Calculate	計算
Outline	概述	Determine	測定
Describe	描述	Deduce	推定/推斷

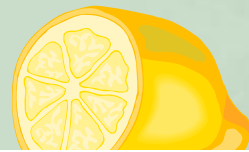
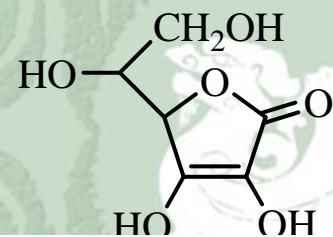


# DSE Chemistry Paper 2

# Q.1(a) Synthesis of vitamin C



- (i) CH<sub>3</sub>OH/HCl
- (ii) CH<sub>3</sub>ONa
- (iii) H<sub>3</sub>O<sup>+</sup>

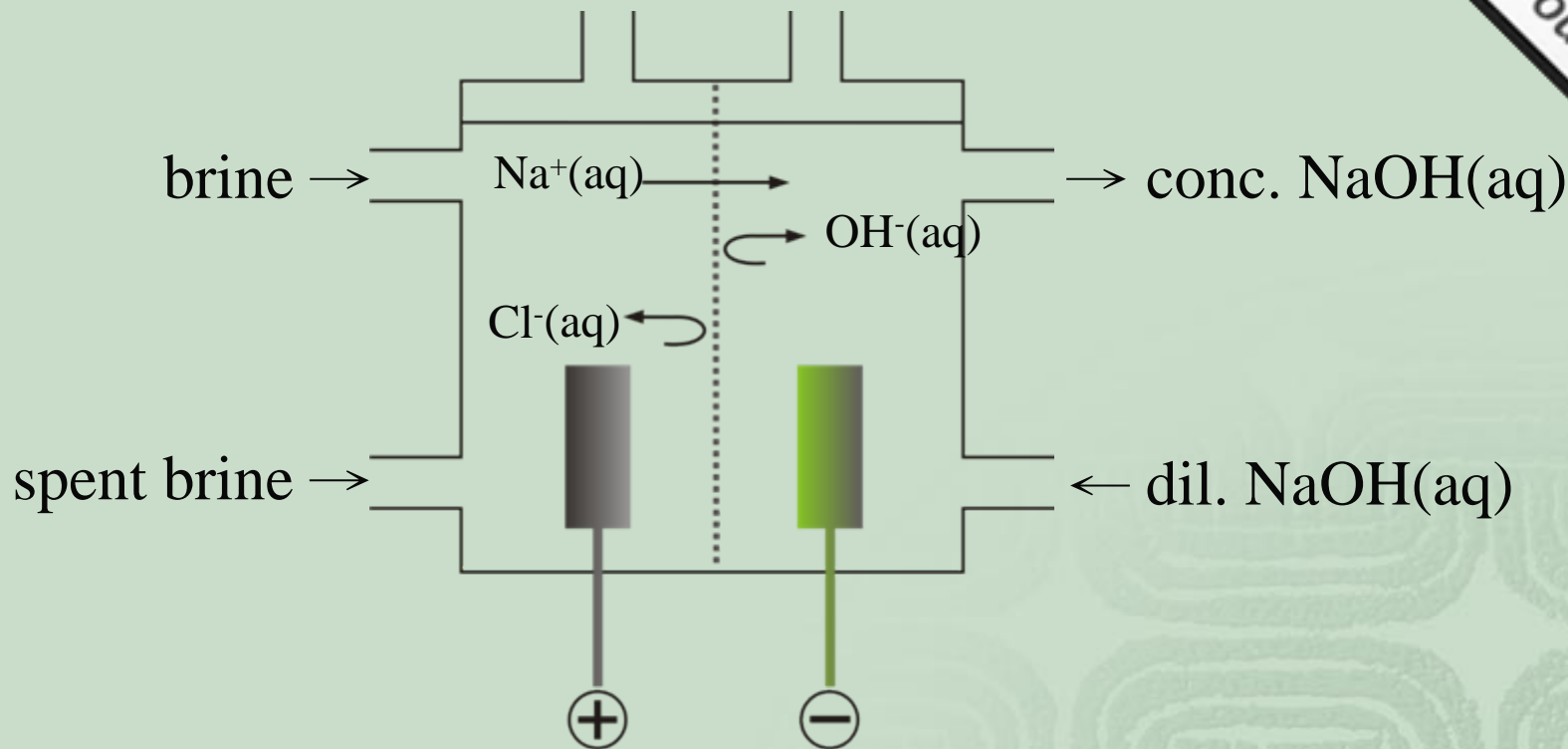


*The Curriculum: Understand the recent progress in industrial processes such as the production of vitamins C to solve problems of inadequate or shrinking supply of natural products*

## **Q.1(a): testing points**

- (i) Importance of Reichstein Process**
- (ii) Type of reaction**
- (iii) Enzymatic reactions**
- (iv) Green Chemistry**

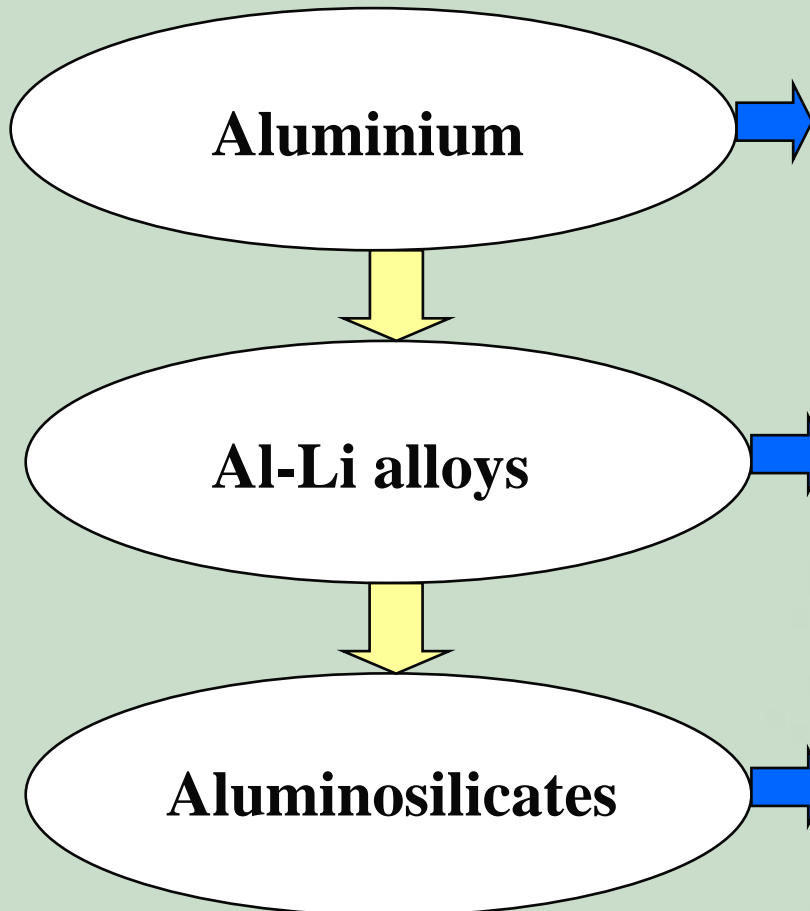
## Q.1(c) Membrane cell in chloroalkali industry



Testing point: (iii) Chemistry in action

'Electrolysis of brine can be used in large scale manufacture of hydrogen to help reduce air pollution problems'

# Q.2(a) Metals and Alloys



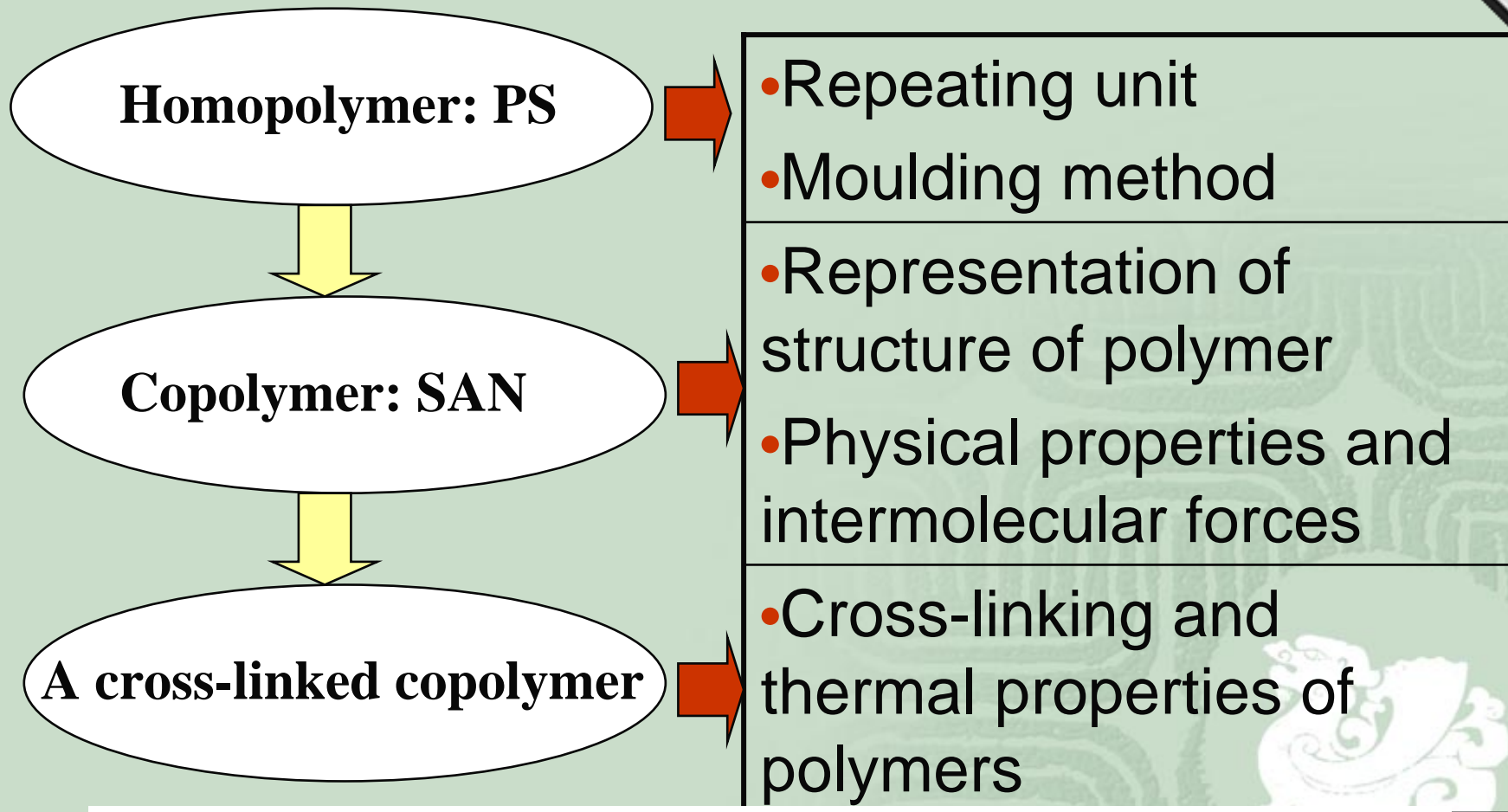
- Unit cell
- Calculation of the density of metal (Al)

- Improving strength by alloying
- Application of alloys

- Relationship between structure and physical properties



# Q.2(b) Synthetic polymers

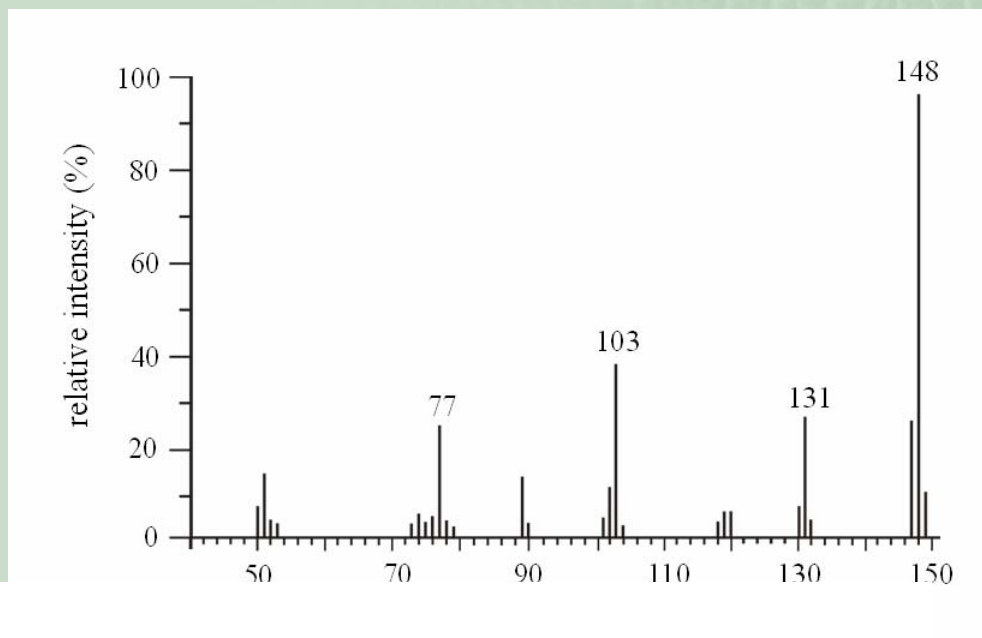
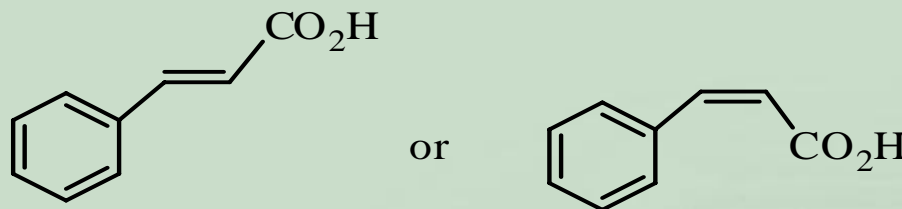




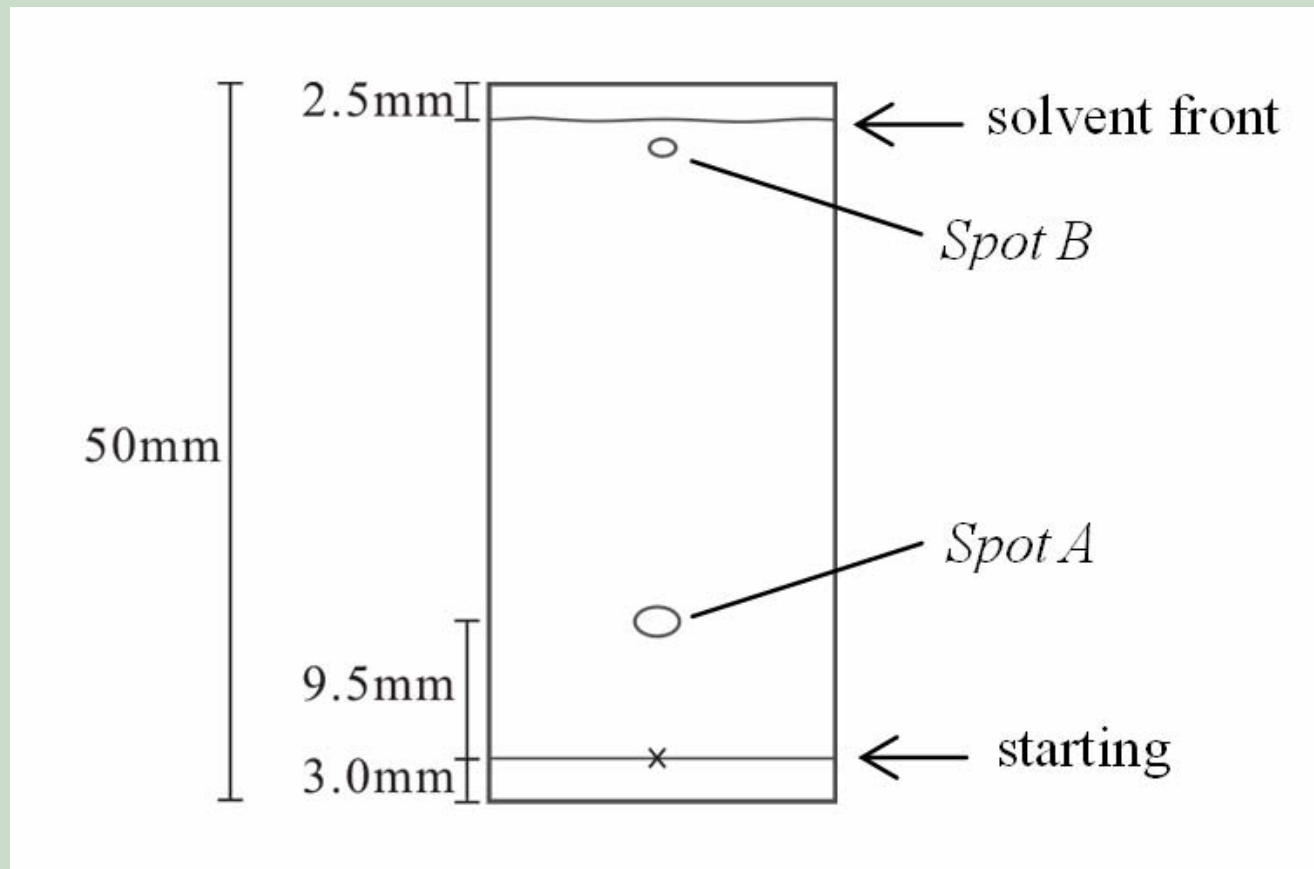
# Q.3(a) Extraction of Organic Compounds and Instrumental Analysis

Testing points:

- Separation method: principle and experimental technique
- Interpretation of mass spectrum
- Chromatography



## Q.3(a) Small and large scale separation (TLC and Column Chromatography)



## Q.3(b) Gravimetric Analysis

- Gravimetric analysis: Principle and experimental techniques
- Calculation on chemical stoichiometry

# Results of the Piloting of Paper 2

<b>Question</b>	<b>No. of students</b>	<b>Mean (out of 20)</b>	<b>S.D.</b>
<b>Q.1</b>	<b>176</b>	<b>8.0</b>	<b>3.0</b>
<b>Q.2</b>	<b>120</b>	<b>5.5</b>	<b>3.3</b>
<b>Q.3</b>	<b>194</b>	<b>6.6</b>	<b>3.7</b>

# Students' Performance in Paper 2



*Break*



# DSE Chemistry Paper 1

## Section B

# Student Performance in the pile of (Paper 1 Section B)

- No. of schools = 4
- No. of participating students = 148
- Mean = 32.6 (39%)
- Standard deviation = 14.3 (17%)

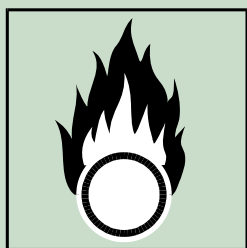
# Student Performance in Section B Part I

Q. No.	Max. mark	Mean	SD
1	8	3.92	1.90
2	5	1.81	1.12
3	6	3.21	1.58
4	7	2.84	2.32
5	6	2.17	1.32
6	9	3.22	1.90
7	9	4.97	1.97
8	6	1.24	1.17

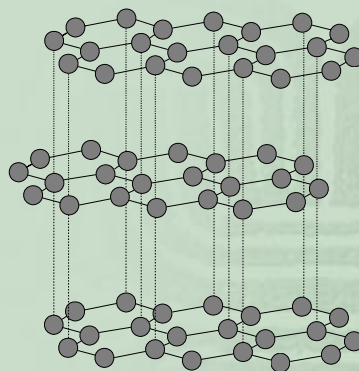
# Student Performance in Section B Part II

Q.No.	Max. mark	Mean	SD
9	8	2.31	2.3
10	5	1.39	1.25
11	3	1.72	1.21
12	4	1.42	1.38
13	8	2.3	1.68

# What is Chemistry?



OXIDISING 氧化性





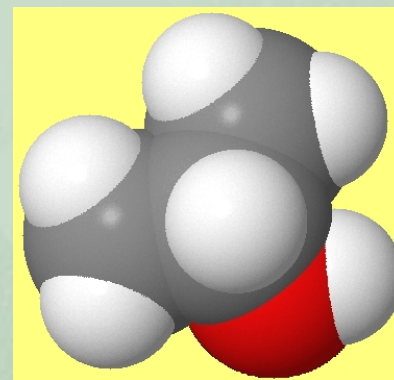
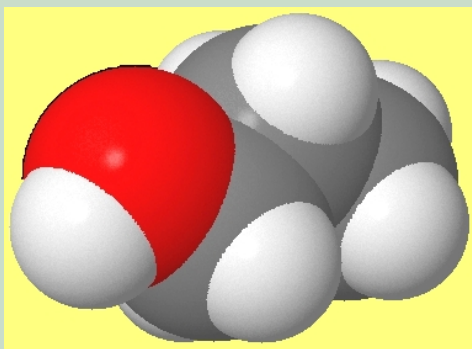
# Some Questions to Illustrate Curriculum Emphases and Skills to be tested



# Q.6 Interpretation of observed phenomenon from molecular level

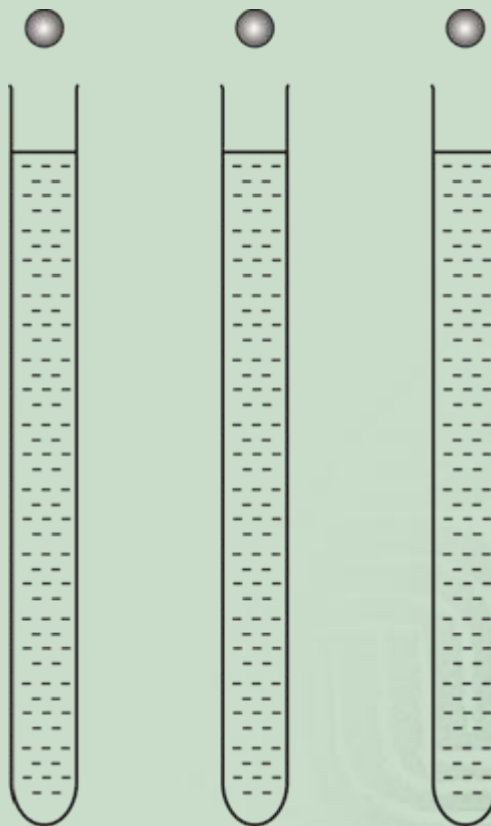
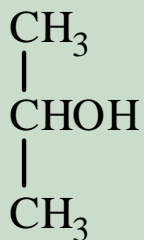
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Density of propan-1-ol and  $>$  Density of propan-2-ol

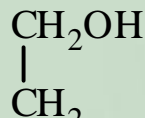
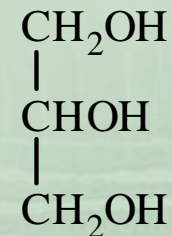


# Q.6 Which of the balls falls most slowly

**Propan-2-ol**

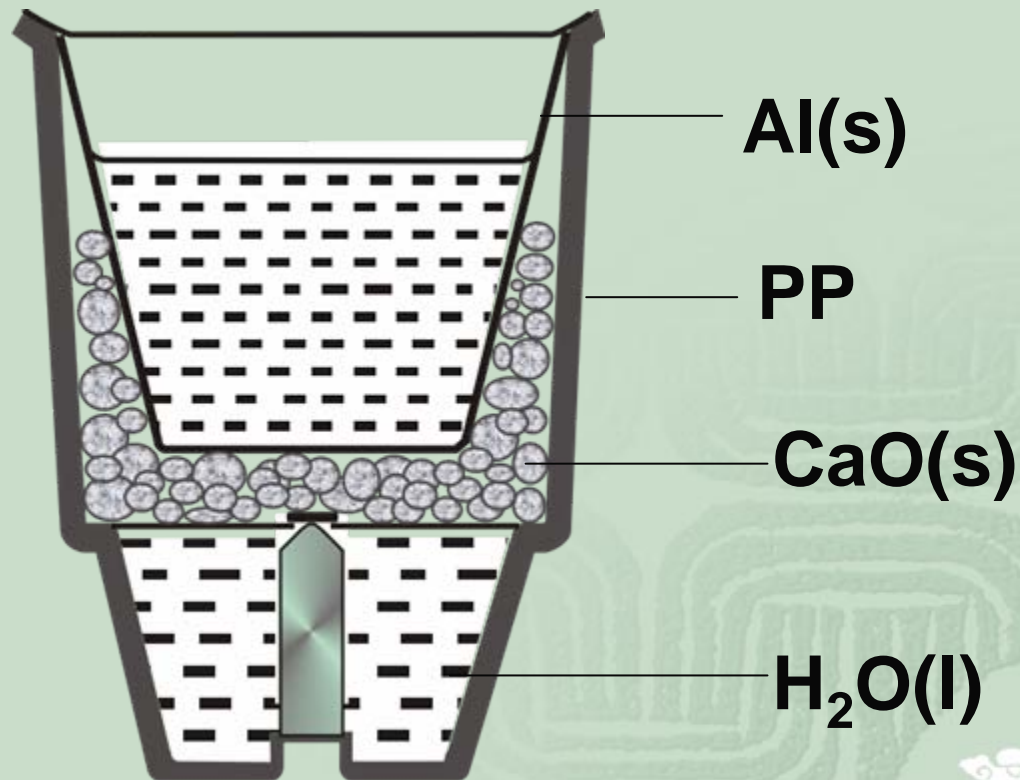


**Propane-1,2,3-triol**



# Chemistry in Daily Life (1)

Q.7 A can of self-heating coffee beverage



# Chemistry in Daily Life (2)

## Q.8 DMFC powered laptop computer

Testing points:

- Electrochemical reactions
- Safety with chemicals
- Prospect of chemistry



*(c) Would you expect DMFC to be widely in powering laptop computers?*

# The Chemistry and Combined Science Papers

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Q.3(b)(ii) VSEPR theory

Q.4 Colour change of indicator

Q.6 (d) Account for the observed phenomenon based on the given physical properties

# Paper 1 Section B Part II





# Q.9 Patterns in Chemistry

PERIODIC TABLE 周期表

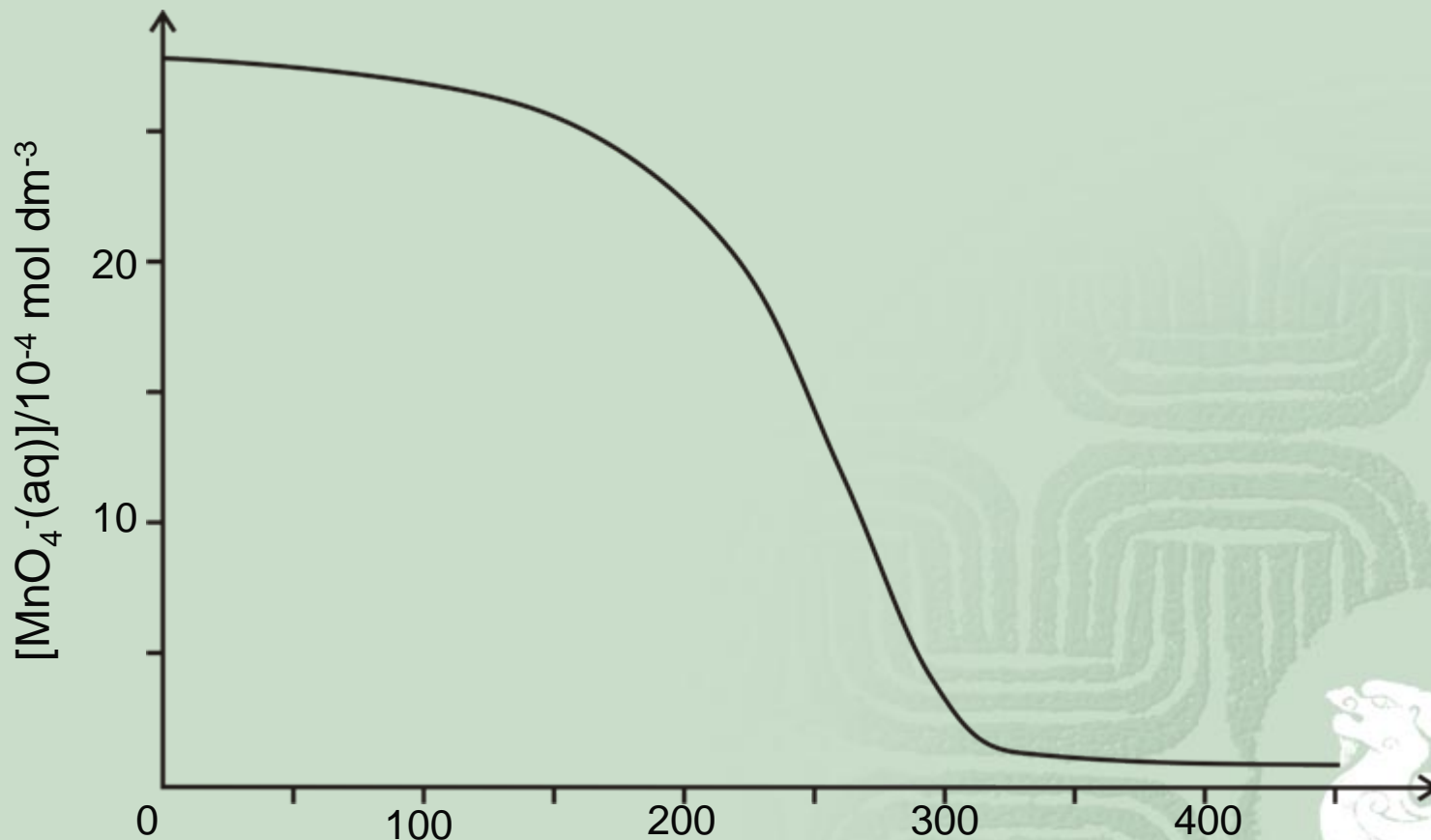
GROUP 族

		atomic number 原子序																	
		1 H 1.0																	
		relative atomic mass 相對原子質量																	
I	II											III	IV	V	VI	VII	2		
3	4											5	6	7	8	9	10		
Li	Be											B	C	N	O	F	Ne		
6.9	9.0											10.8	12.0	14.0	16.0	19.0	20.2		
11	12											13	14	15	16	17	18		
Na	Mg											Al	Si	P	S	Cl	Ar		
23.0	24.3											27.0	28.1	31.0	32.1	35.5	40.0		
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr		
39.1	40.1	45.0	47.9	50.9	52.0	54.9	55.8	58.9	58.7	63.5	65.4	69.7	72.6	74.9	79.0	79.9	83.8		
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54		
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe		
85.5	87.6	88.9	91.2	92.9	95.9	(98)	101.1	102.9	106.4	107.9	112.4	114.8	118.7	121.8	127.6	126.9	131.3		
55	56	57 *	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86		
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn		
132.9	137.3	138.9	178.5	180.9	183.9	186.2	190.2	192.2	195.1	197.0	200.6	204.4	207.2	209.0	(209)	(210)	(222)		
87	88	89 **	104	105															
Fr	Ra	Ac	Rf	Db															
(223)	(226)	(227)	(261)	(262)															

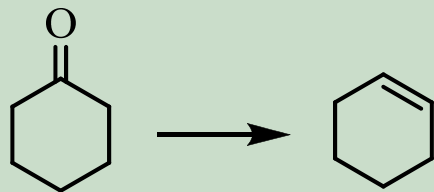
*	58	59	60	61	62	63	64	65	66	67	68	69	70	71
	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
	140.1	140.9	144.2	(145)	150.4	152.0	157.3	158.9	162.5	164.9	167.3	168.9	173.0	175.0
**	90	91	92	93	94	95	96	97	98	99	100	101	102	103
	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
	232.0	(231)	238.0	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(260)

# Q.10 Interpretation of experimental results and controlled experiment

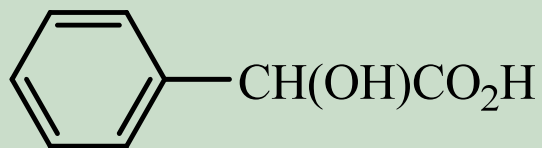
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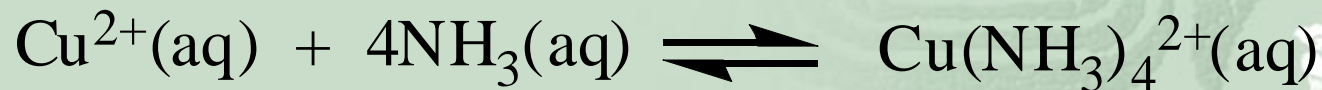
## Q.11 Organic synthesis



## Q.12 Optical isomerism and polymers



## Q.13 Chemical equilibrium: shifting of equilibrium position



# Student Performance in Paper 1 Section B

# Standards Setting in 2012

- Level descriptors
- Panel judges
- Making reference to standards of AL and CE exams
- Statistical data - Group Ability Index (GAI) to reflect overall performance (ability) in the core subjects for all candidates taking a subject (group) to be used as reference by the panel judges to determine cut scores for elective subjects
- HKEAA internal meeting



# Cut scores for Combined Science

- Cut scores of each half-elective to be determined with reference to the cut scores of the corresponding full-elective subjects using a statistical method that serves to equate the standard between the two
- Cut scores of the two half-elective subjects to be added up to form the cut score of Combined Science





# Levels 5\* and 5\*\*

- Level 5\*\* will be awarded to the highest-achieving 10% (approximately) of Level 5 candidates
- Level 5\* will be awarded to the next highest-achieving 30% (approximately) of Level 5 candidates

http://www.hkeaa.edu.hk/en/hkdse/Practice\_Pap

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Friday, 10 February, 2012

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HKALE

HKDSE

HKCEE

School-based Assessment

International Recognition

BCA/TSA

LPAT

Other Exams and Assessments



### Practice Papers for HKDSE Subjects

#### Core Subjects

Chinese Language	<a href="#">Click here</a>
English Language	<a href="#">Click here</a>
Mathematics	<a href="#">Click here</a>
Liberal Studies	<a href="#">Click here</a>

#### Elective Subjects

Biology	<a href="#">Click here</a>
Business, Accounting and Financial Studies	<a href="#">Click here</a>
Chemistry	<a href="#">Click here</a>
Chinese History	<a href="#">Click here</a>
Chinese Literature	<a href="#">Click here</a>
Design and Applied Technology	<a href="#">Click here</a>
Economics	<a href="#">Click here</a>
Ethics and Religious Studies	<a href="#">Click here</a>

#### Section Focus

##### HKDSE

Special Edition on HKDSE Liberal Studies

- About HKDSE
- Important Dates
- Exam Registration
- Exam Regulations
- Handbook for Candidates
- Subject Information
- Assessment Framework
- Marking and Processing of Marks
- The Reporting System
- Sample Papers
- Level Descriptors
- Practice Papers



HKALE
HKDSE
HKCEE
School-based Assessment
International Recognition
BCA/TSA
LPA
Oth



Category A - HKDSE Elective Subjects:

- Practice Papers
- Marking Schemes (Provisional)
- Report on Student Performance in the Practice Papers
- Samples of Student Performance in the Practice Papers

Available in March

# Q & A



THANK  
YOU



# Chemistry Practice Papers

## Students' Performance in Paper 2



# Industrial Chemistry (Q.1)

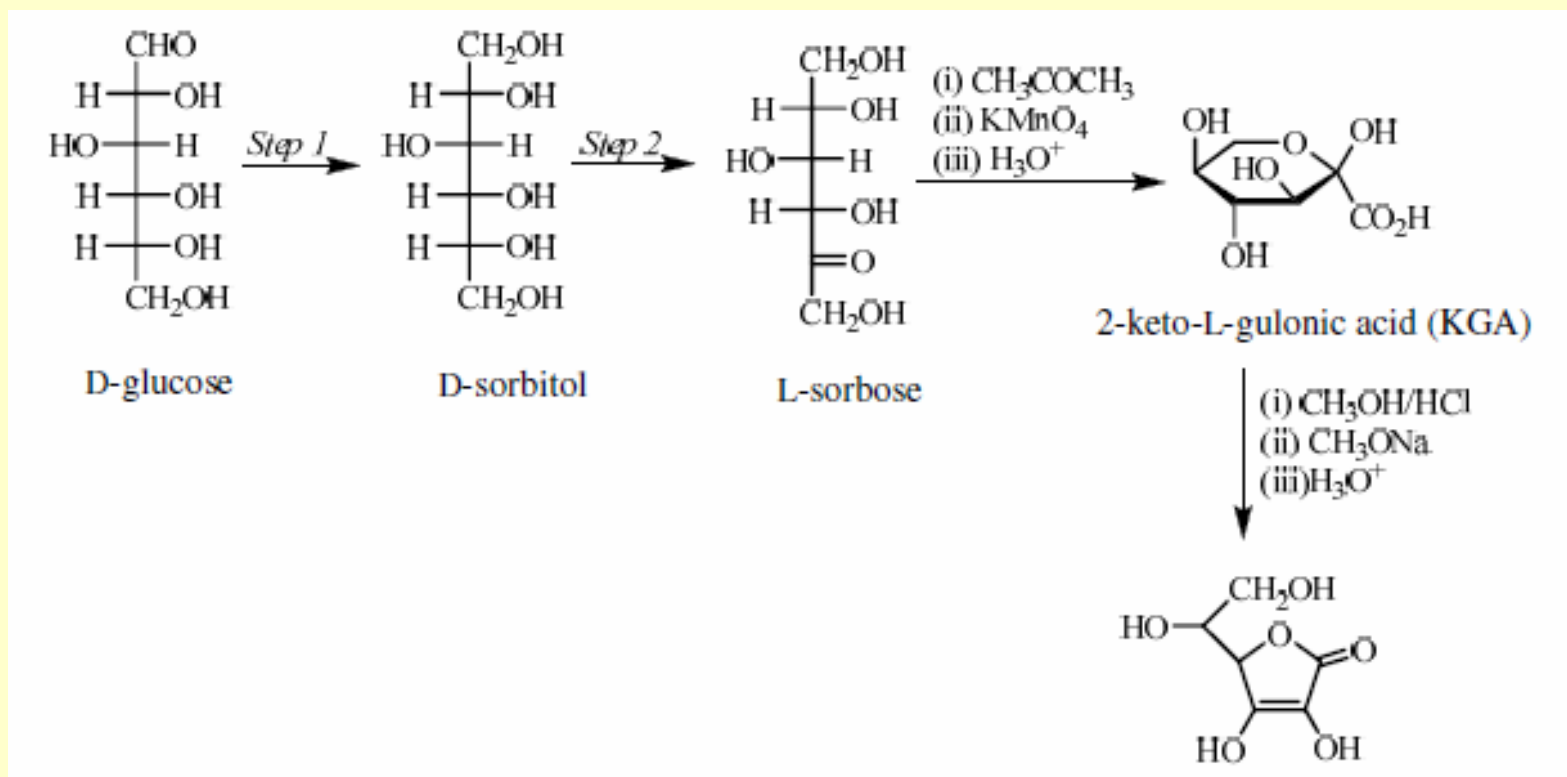
## Theme

- (a) Vitamin C synthesis
- (b) Kinetics:
- (c) Membrane cell: Manufacture of chlorine, hydrogen and sodium hydroxide

# Industrial Chemistry (Q.1)

## Theme

- (a) Vitamin C synthesis

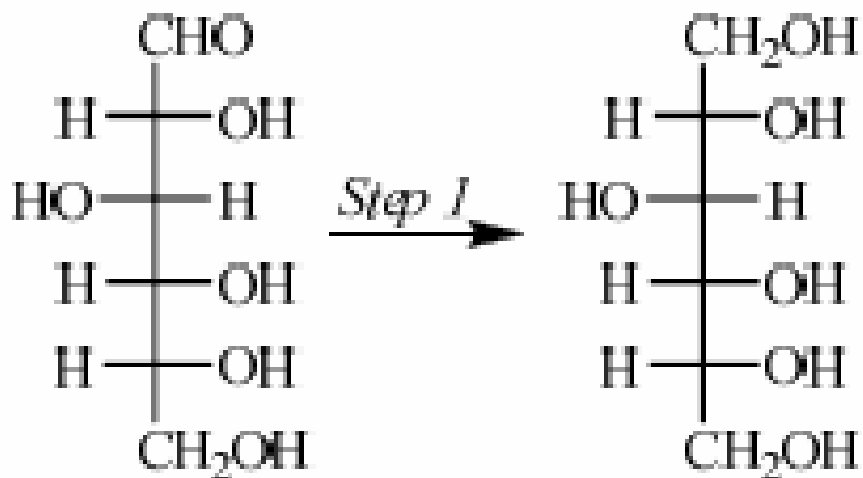


# Comments on students' performance

- **(i) ONE importance of the process**
- Some students failed to pinpoint the importance of this process. They simply copied from the question that the process is for **the synthesis of vitamin C**.
- Expected answer:
  - Meet the demand
  - Producing something more useful to mankind
  - ...

# Comments on students' performance

- (ii) Type of reaction involved
- Well answered.

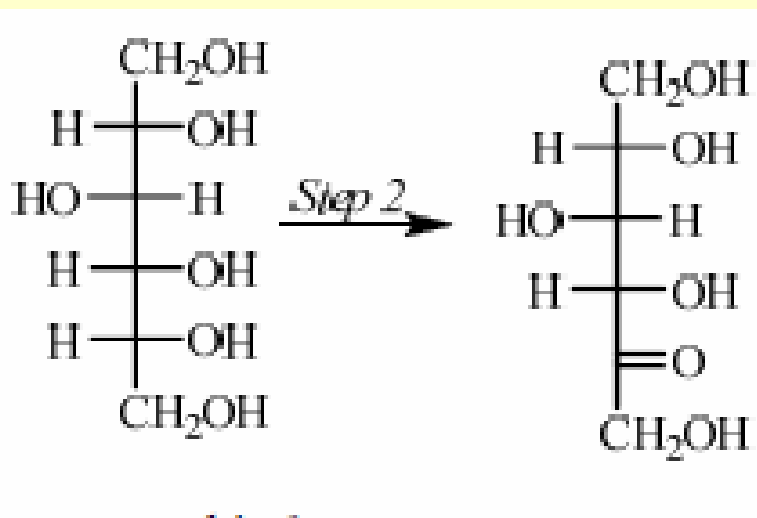


D-glucose

D-sorbitol

# Comments on students' performance

- (i) Step 2
  - (I) NOT carried out with commonly used oxidising agents?
  - (II) Carried out at pH 4 to 6



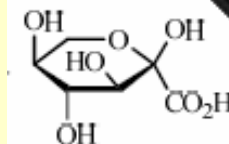
# Comments on students' performance

- (iii) Students should note that enzymes
  - are **selective**
  - **denature** at low pH



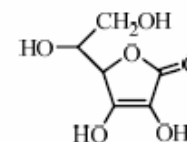
# Comments on students' performance

- (iv) Why greener?



2-keto-L-gulonic acid (KGA)

(i)  $\text{CH}_3\text{OH}/\text{HCl}$   
(ii)  $\text{CH}_3\text{ONa}$   
(iii)  $\text{H}_3\text{O}^+$



L-ascorbic acid

- Expected answers must be **context-based**
  - Toxicity of reagents used
  - Enzyme as catalyst

# Sample: high performance

- (i) It synthesizes more vitamin C to meet the increasing demand due to rising population. ✓
- (ii) Catalytic hydrogenation. ✓

# Sample: high performance

(iii) (I) commonly oxidising agents can oxidize any hydroxyl group (-OH) in D-sorbitol so the product will involve a mixture of compound which may not be L-sorbose.

(II) pH 4 to 6 are the optimum temperature for sorbitol dehydrogenase to work the best. (highest reaction rate)

# Sample: high performance

(iv) This method involves no use of toxic reagent but the Reichstein process involves the use of toxic methanol.

This method employs enzyme (gluconolactonase) but the Reichstein process involves no catalyst for forming  $\gamma$ -ascorbic acid from KGA, so this process has lower energy requirement.

# Industrial Chemistry (Q.1)

## Theme

- (a) Vitamin C synthesis
- (b) Kinetics:
- (c) Membrane cell: Manufacture of chlorine, hydrogen and sodium hydroxide

# Comments on students' performance

- (i) First order reaction?
- Some failed to point out the **characteristics / meaning** of a first order reaction.
  - Constant half-life
  - Rate =  $k [A]$



# Comments on students' performance

- (ii) Determination of activation energy using a graphical method.
- Some students
  - did **not use graph paper** to plot the graph.
  - gave **unit** after taking **logarithm**, or did not give an appropriate unit to  $1/T$
  - **added 273** to the **absolute temperatures** given

# Sample: high performance

(i) For first order reaction, the sum of orders of reaction with respect to different reactants is only 1. <sup>that is,</sup> If the reaction involves only one reactant, the rate of reaction is directly proportional to the concentration of reagent.

# Sample: high performance

$$(ii) \ln k = \ln A - \frac{E_a}{RT}$$

we can plot a graph of  $\ln k$  against  $\frac{1}{T}$ , from the graph, the slope represents  $-\frac{E_a}{R}$  ✓

Tabulation:

$\frac{1}{T} \times 10^3 \text{ K}^{-1}$	3.20	3.10	3.00	2.92
$\ln k$	-3.61	-3.34	-2.99	-2.73

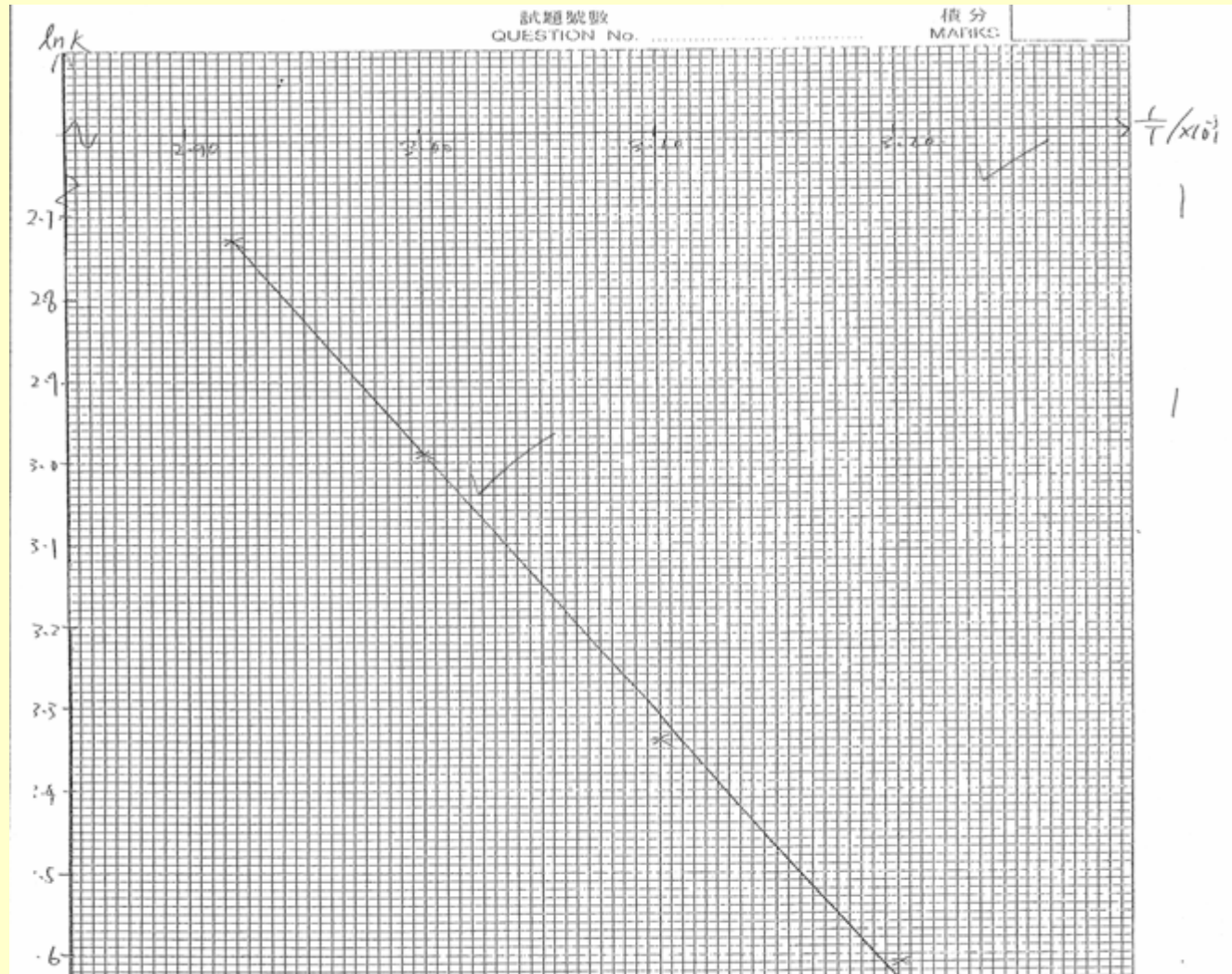
$$\text{From the graph, slope} = \frac{-2.99 - (-2.73)}{(3.00 - 2.92) \times 10^3} \quad \checkmark$$

$$= -3250 = -\frac{E_a}{R}$$

$$E_a = -(-3250) \times 8.31$$

$$= +27007.5 \text{ J mol}^{-1} \quad \checkmark$$

# Sample: high performance



# Industrial Chemistry (Q.1)

## Theme

- (a) Vitamin C synthesis
- (b) Kinetics:
- (c) Membrane cell: Manufacture of chlorine, hydrogen and sodium hydroxide

# Comments on students' performance

- (i) Give half-equations for cathodic and anodic reactions, and account for the formation of  $\text{H}_2$ ,  $\text{Cl}_2$  and  $\text{NaOH}$
- Some students did not give an explanation for the formation of  $\text{H}_2$ ,  $\text{Cl}_2$ ,  $\text{NaOH}$ 
  - Preferential discharge
  - Concentration
  - Membrane being selective



# Comments on students' performance

(ii) Equation for  $\text{Cl}_2 + \text{NaOH}$

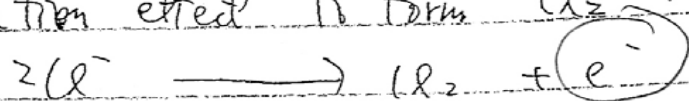
- Well answered

(iii) Electrolysis of brine for large scale manufacture of hydrogen – Agree?

- Some failed to recognise that
  - large scale manufacture of  $\text{H}_2(\text{g})$  by electrolysis of brine would bring about surplus  $\text{Cl}_2(\text{g})$ , and
  - the disposal of which could pose other environmental problems

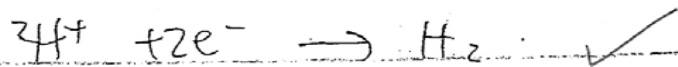
# Sample: high performance

(i) At anode,  $\text{Cl}^-$  and  $\text{OH}^-$  ions move to it, the concentration of  $\text{Cl}^-$  is much higher than  $\text{OH}^-$ , it is discharged due to concentration effect to form  $\text{Cl}_2$ .



Excess  $\text{Na}^+$  remains because  $\text{Cl}^-$  is discharged.

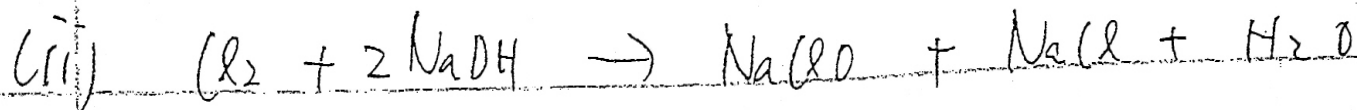
At cathode,  $\text{Na}^+$ ,  $\text{H}^+$  ions move to it, the  $\text{H}^+$  ions will be preferentially discharged because it has lower position than  $\text{Na}^+$  in the electrochemical series, thus  $\text{H}_2$  is formed.



As  $\text{H}^+$  is discharged, excess  $\text{OH}^-$  remains.

The membrane only allows ~~the~~  $\text{Na}^+$  to move from anode compartment to cathode compartment, but not gases, water and acids, excess  $\text{Na}^+$  can result in concentrated

# Sample: high performance



(iii) I disagree with him because large amount of electrical energy is required to form a small amount of  $\text{H}_2$  because the enthalpy of decomposition of  $\text{H}_2\text{O}$  into  $\text{H}_2$  and  $\text{O}_2$  is large. Manufacture of  $\text{H}_2$  is done by steam-methane reforming process instead. ✓

# Comments on students' performance

- (i) Unit cell, and simple calculations
  - Name type of unit cell
  - Number of atoms in a unit cell
  - Density of solid aluminium
- Well answered. Some were not good in **unit conversions** in part (III)

# Comments on students' performance

- (ii) (I) Why strength of Al can be improved by alloying?
- (II) Advantage of using aluminium-lithium alloys?
- Generally well-answered except some stated that the advantage is that the resulting alloy (Al and Li) is 'lighter'.

# Comments on students' performance

- (iii) (I) Why biotite flake off easily?
- (II) one application?
- Some
  - did not make use of the given information about the **layered structure** OR
  - simply explained by just stating that the structure is layered without further elaboration



# Sample: mid performance

a) Face-centre cubic ✓

ii) The number of atoms in one unit cell =  $\frac{1}{2} \times 6 + \frac{1}{8} \times 8 = 4$  ✓

iii) The mass of a unit cell of aluminium =  $\frac{27}{6.02 \times 10^{23}} \times 4 = 1.79 \times 10^{-22}$  g ✓

The density =  $\frac{1.79 \times 10^{-22}}{(4.05 \times 10^{-10})^3} = 2.7 \times 10^6 \text{ g m}^{-3} = 2.7 \text{ g cm}^{-3}$  ✓

# Sample: mid performance

(i) The atoms of another metal place in the empty space of a aluminium cubic which increase the coordination number of atoms. The strength of aluminium alloy will increase.

(ii) The alloy is light

# Sample: mid performance

iii) I.	Since the intermolecular force between layer is weak that can <del>be</del> easily	
break down	✓	
ii).	For making chips	
	X	

# Comments on students' performance

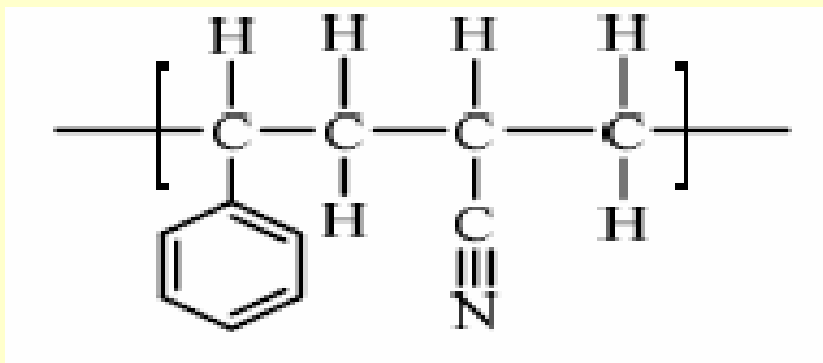
- (b) (i) (I) PS monomer?
- (II) moulding method?
- Well answered.



# Comments on students' performance

- (ii)

(I) Why the following structure cannot be the repeating unit?



(II) SAN can withstand higher temperatures than PS. Why?

# Comments on students' performance

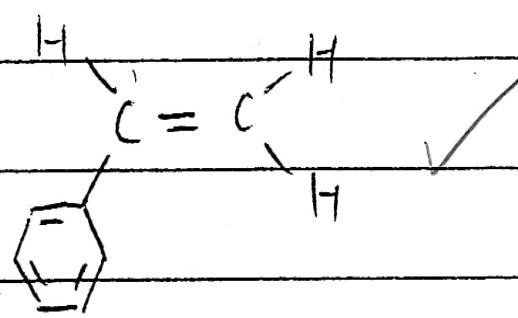
- (ii) (I) Failure to recognise
  - Random arrangement of the monomers
  - 1:1 stoichiometric ratio
- (II) Being unable to recognise the **different interactions** involved
  - Dipole-dipole interaction vs. van der Waals forces



# Comments on students' performance

- (iii) ... produces a plastic material which is hard, rigid and does not melt upon heating. Explain, in terms of bonding and structure.
- Failure to read the question carefully
- Expected answers
  - Thermoset or similar meanings in sentences
  - Cross-links with diagram showing how the cross-linkages can be formed

# Sample: mid performance

2 bit		1
II. Injection moulding	✓	1

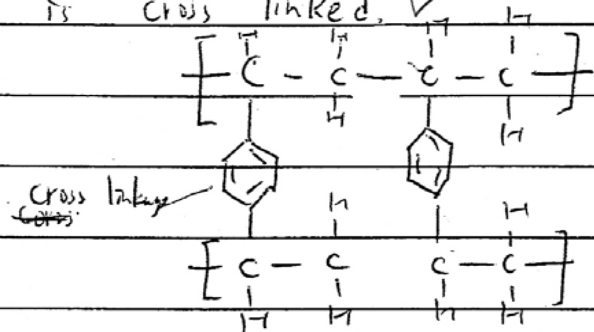
# Sample: mid performance

ii) Since there are chiral centres in the molecule, which form different enantiomers, the structure of SAN should be in 3-dimension to state the differences between enantiomers. X

ii) Both polymer chains in SAN and PS are held by van der Waals' force. But the molecular size of SAN is larger than that of PS. Larger the molecular size, larger the van der Waals' force, SAN has stronger intermolecular force which is required to break down. Thus it is a stronger material. X

# Sample: mid performance

b(iii) After polymerization of 1,4-divinylbenzene, it forms polymer chains which is cross linked. ✓



The cross linkage is a strong bond which do not break down even in high temperature. Also, the bulky effect on the cross link make the plastic material hard and rigid. ✓

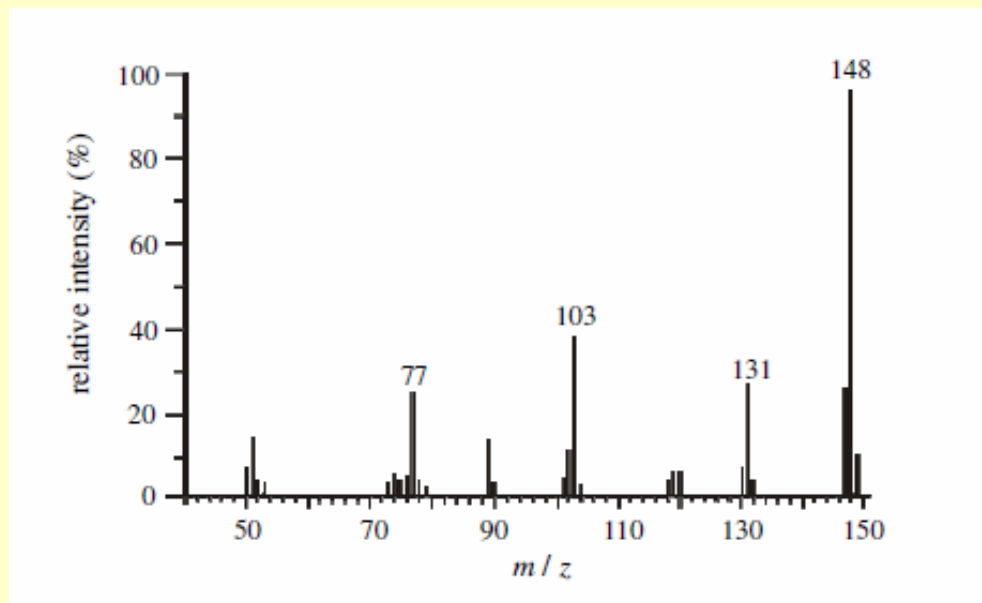
Thus the plastic not melt upon heat.

The hard and rigid properties are due to the cross-link between

# Analytical Chemistry (Q.3)

## Theme

- (a) Extraction and structure determination of an organic compound



- (b) Gravimetric analysis

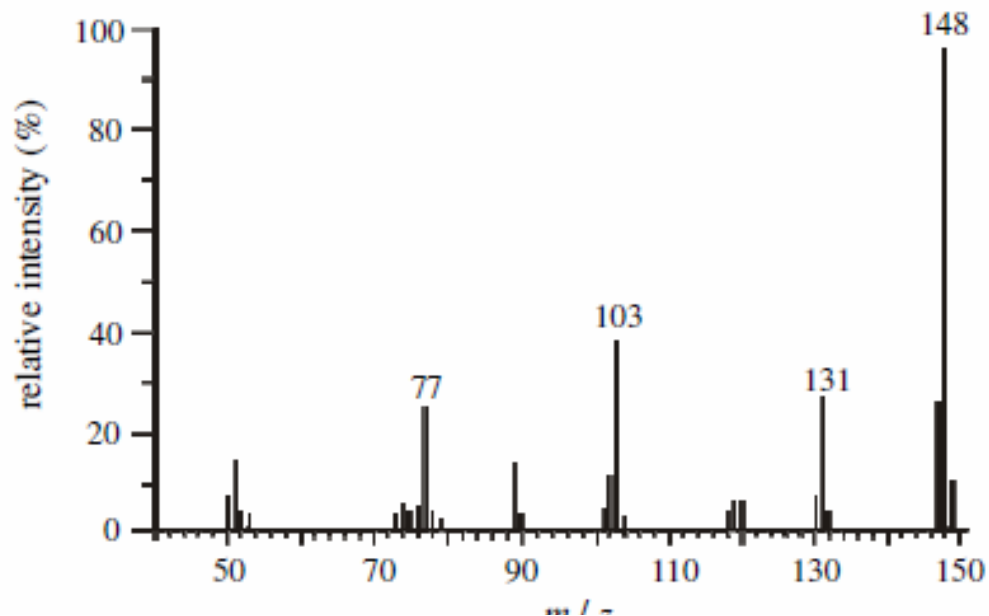
# Comments on students' performance

- (a)
- (i) ONE functional group present?
- (ii) Name the apparatus used.
- (iii) Purposes of Steps 1, 2 and 3.
- Generally well-answered.



# Comments on students' performance

- (iv) Given: Decolorise  $\text{Br}_2$  in  $\text{CH}_3\text{CCl}_3$  and mass spectrum.



# Comments on students' performance

- Able to deduce the presence of C=C bond and to identify the molecular-ion

BUT

- Some students **wrongly perceived X to be an ester** and were unable to deduce a possible structure of **X**.

# Comments on students' performance

- (v) Given results of TLC, ask for (I) how to make the spots visible, (II)  $R_f$  determination, and (III) one method to separate X from the sample
- (I) Should note that one may detect the spots by using **UV** or by using **iodine vapor**
- (II) Well answered
- (III) Many did not recognise the use of **column chromatography** for separation

# Sample: low performance

3ai) ester X

3aii) separating funnel

3aiii) For step 1, it's to

For step 2, it's to separate the organic substances  
and inorganic substances

For step 3, it's to form carboxylic acid to make  
the solution acidic for the esterification.

2. ...

# Sample: low performance

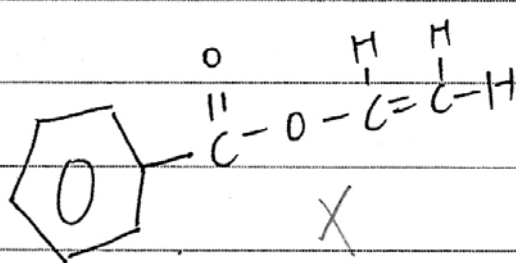
$$3 \text{ aiv) } (9 \cdot 12 + 8 \cdot 1 + 2 \cdot 16) n = 148$$

$$n = 1$$

X

∴ molecular formula is  $C_9H_8O_2$

At  $m/z = 77$ , it is likely to be  $C_6H_5$ . The other part may be  $C_3H_3O_2$ . Since it is not soluble in water, it should be ester.



Because of decolorization of  $Br_2$  in  $CH_2Cl_2$ , it should be alkene present. ✓

Please do not write in the margin. 請勿在此書寫。

# Sample: low performance

2a(v) (I) add dye to the organic compound to  
make it visible X

$$3a(v) (II) R_f = \frac{9.5}{(50 - 2.5 - 3)} = 0.2135 \text{ " } \checkmark$$

(III) add alcohol to the sample in order to  
remove the colourless organic compound because  
the compound's more soluble in the alcohol - X  
water solvent. ~~then use separating~~





# Comments on students' performance

- (i) Two necessary treatments before mass determination.
- Should note that:
  - The sample **must not be contaminated** with other impurities – wash with deionised water
  - The sample must be **thoroughly dried** – in oven

# Comments on students' performance

- (ii) percentage by mass of barium in the sample.
- Quality of answers depends on the understanding of **chemical stoichiometry**

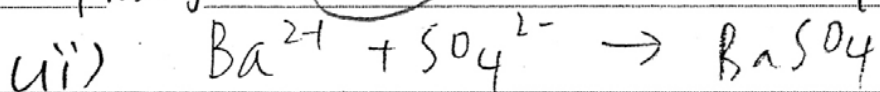
# Comments on students' performance

- (iii) TWO conditions for gravimetric method suitable for quantitative analysis
- Expected answers
  - Complete reaction
  - Product should have a definite composition
  - Rate of reaction fast enough to be practical

# Sample: low performance

3b (i) Drying the precipitate by filter paper. X

Firstly, use water to clean the surface of  $\text{BaSO}_4$  and X



Since  $\text{Ba}^{2+}$ 's limited, 0.291

$$\text{no. of BaSO}_4 = \text{no. of Ba}^{2+}$$

$$\frac{0.291}{(137.3 + 32.1 + 16 \times 4)} = 0.001247 \quad \checkmark$$

$$\frac{\text{mass of Ba}^{2+}}{\text{mass of Barium salt}} \times 100\% = \frac{0.001247(137.3)}{0.308} \quad \checkmark$$

$$\times 100\% = 56.13\% \quad \checkmark$$

在此書寫。

# Sample: low performance

(iii) the compound is in solid. X

The compound is not complex. X  
structure of the

*End*



# Chemistry Practice Papers

## Students' Performance in Paper 1 Section B Part II

## Q.9(b)

Many students gave answers based on **structure rather than on bonding of the oxides**. They got **0 marks**.

- e.g. **ionic crystals is basic**,  
**simple molecular structure is acidic**.  
**/Metal oxide is basic**,  
**non-metal oxide is acidic**.

## Q.9(c)

- In general, students used 2 approaches to answer this part
- (i) dissolve the oxide in water and test the pH  
Since some of the oxides are insoluble, full mark would not be awarded.
- (ii) add the acidic oxides to alkali, basic oxides to acid etc. and state the expected observation.
- Some students just used equations to answer the question so they could not get marks for communication.

# Q.10

- (a) Some students wrote “observe the colour” instead of “colorimetry”.
- (b)(i) The question asked for evidence from the graph, but some students ignored this.
  - (ii) Although the question is simple, the performance of students was unsatisfactory.

Many students did not mention, “add  $\text{Mn}^{2+}(\text{aq})$  to the reaction mixture at the beginning of the repeated experiment”

# Q.11

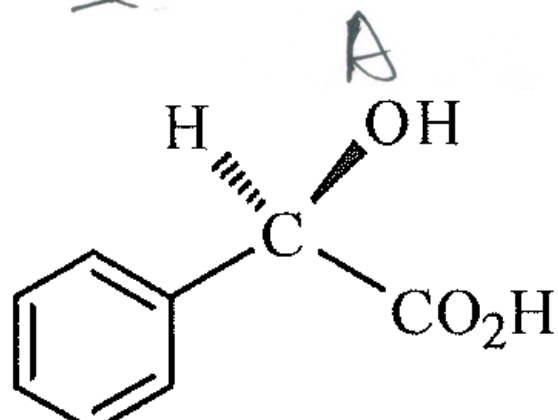
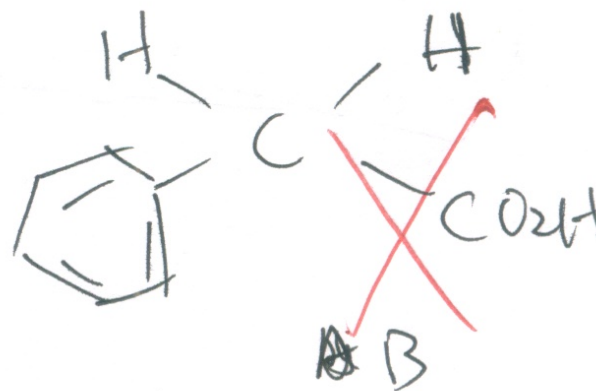
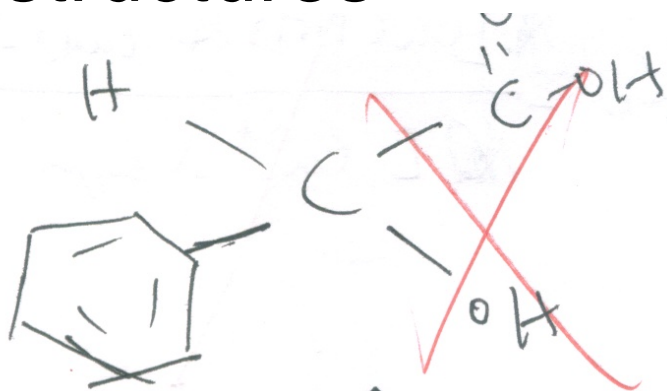
- Sometime students gave **incorrect** reagents or reaction conditions for the conversions,

e.g.  $\text{LiAlH}_4$ , **reflux/**

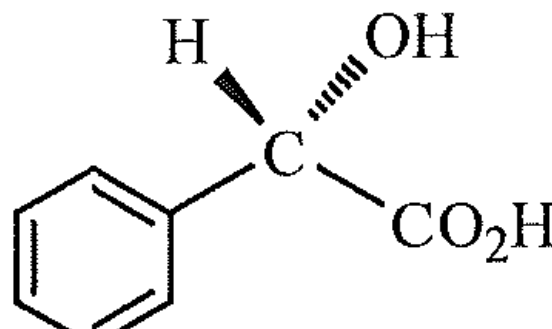
$\text{LiAlH}_4$  **in water/**  $\text{H}_2\text{SO}_4(\text{aq})$

# Q.12

- (a)(i) Students were weak in drawing 3-D structures

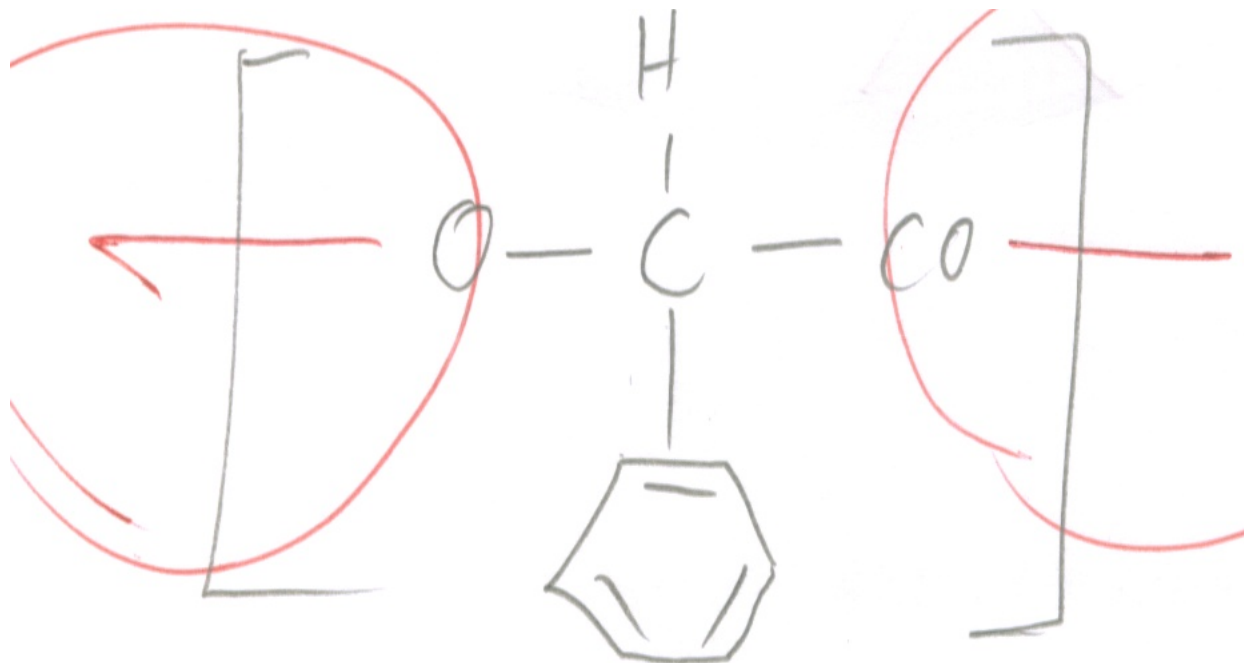


and



# Q.12(b)

- Students made **careless mistakes** in drawing the **repeating unit**, e.g.





# Q.13

- (b) Students were **weak in** using calculators. Many correctly substituted the given data into the equilibrium expression but **were unable to arrive at the correct answer**. Some had **difficulty** in giving the **correct units** to the final answer.
- (c) This is a **difficult** part and students' performance was **poor**.

*END*