



香港科技大學

THE HONG KONG UNIVERSITY OF
SCIENCE AND TECHNOLOGY

ENHANCING CONCEPTUAL UNDERSTANDING WITH CLASSROOM RESPONSE SYSTEMS

Dr. YIP, W. P.

Dr. CHAN, Dennis H. W.

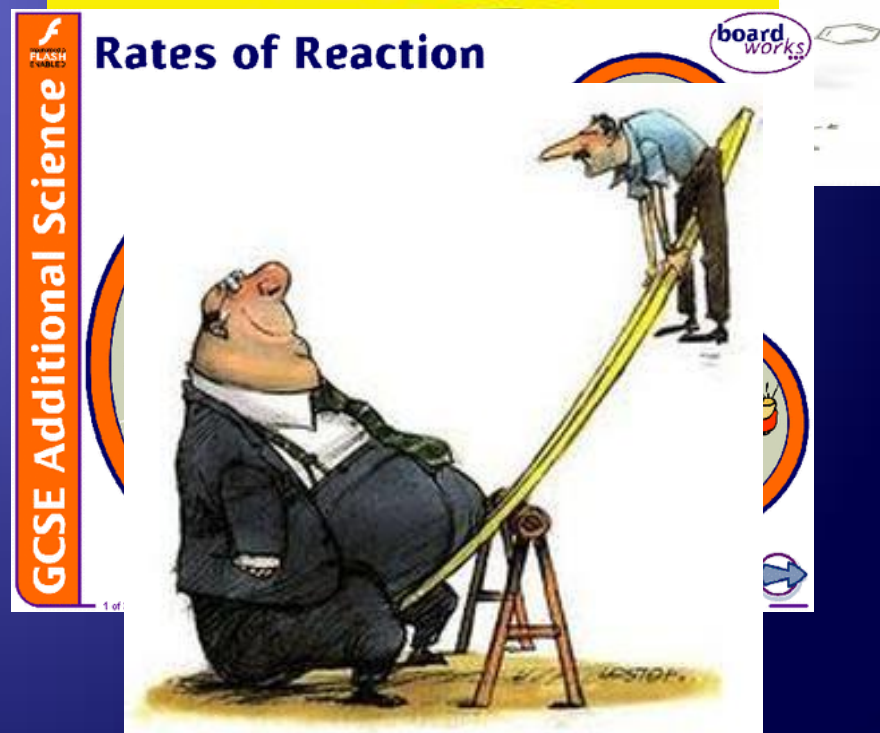
Department of Chemistry

HKUST

11th June 2014

Question Banks

- ◆ Chemical Structure and Properties
- ◆ Organic Chemistry
- ◆ Chemical Reaction and Energy
- ◆ Rate of reaction
- ◆ Chemical Equilibrium



Question Banks

- ◆ 10 Questions for each topics with full explanation
- ◆ English and Chinese versions available
- ◆ Questions are designed base on
 1. Past examiners' report at HKALE
 2. Misconception from undergraduate students

(a) What is meant by the term 'isotope'?

Isotope means the same atom which has same number of protons but different number of neutrons.

(a) 「同位素」一詞是什麼意思？

同-元素但所含的中子數目不同

Explain qualitatively the effect on the initial rate of the reaction of replacing the 2.0 M HCl(aq) with 2.0 M H_2SO_4 (aq).

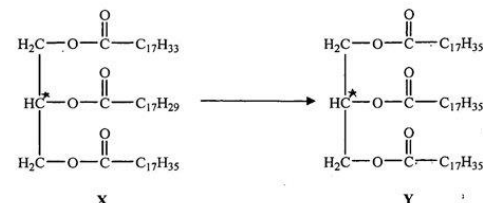
Initial rate of the reaction when 2.0 M H_2SO_4 is used, it will faster than that of 2.0 M HCl. Tangent of the slope at t_0 will deeper. (1 mark)

Upon completion of the reaction, all the zinc powder was used up. Calculate the theoretical

Explain qualitatively the effect on the initial rate of the reaction of replacing the 2.0 M HCl(aq) with 2.0 M H_2SO_4 (aq).

Initial rate would be higher.

The diagram below shows the conversion of an oil molecule X to a fat molecule Y.



(i) Given that all alkyl groups in both X and Y are straight chains, label the chiral carbon(s) by using '*' in the above diagram.

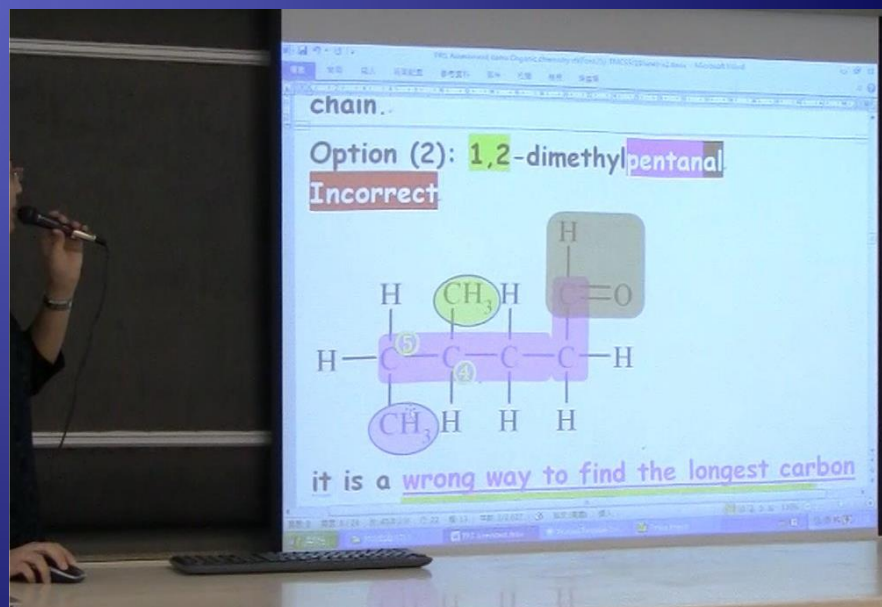
(ii) With reference to (i), explain whether a change in optical activity is involved in the above conversion.

No. As both molecule have original carbon, so they are active in front of optical light.

Performance

- Try-out lessons for 3 Schools, with 2 topics

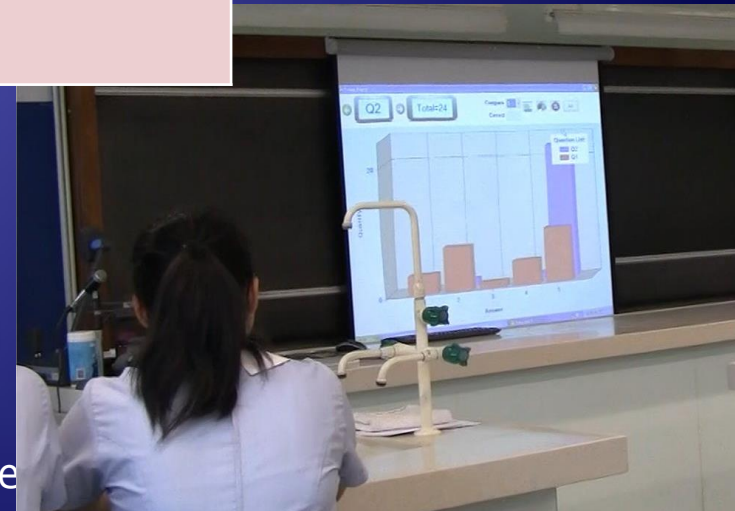
	School A	School B	School C
Chemical Structure and Properties	✓		
Organic Chemistry		✓	✓



School A – Score on 5 Questions*

English Class (9 students)	Chinese Class (19 students)
5 (55%)	12 (63%)
4 (44%)	12 (63%)
1 (11%)	0 (0%)
6 (66%)	16 (84%)
5 (55%)	17 (89%)

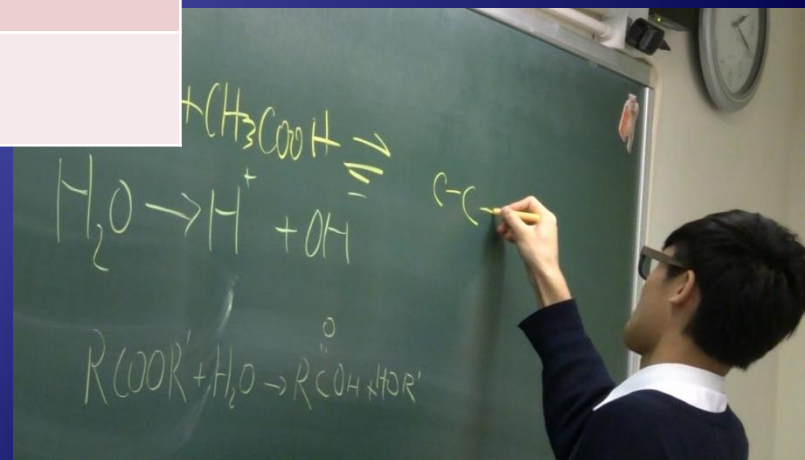
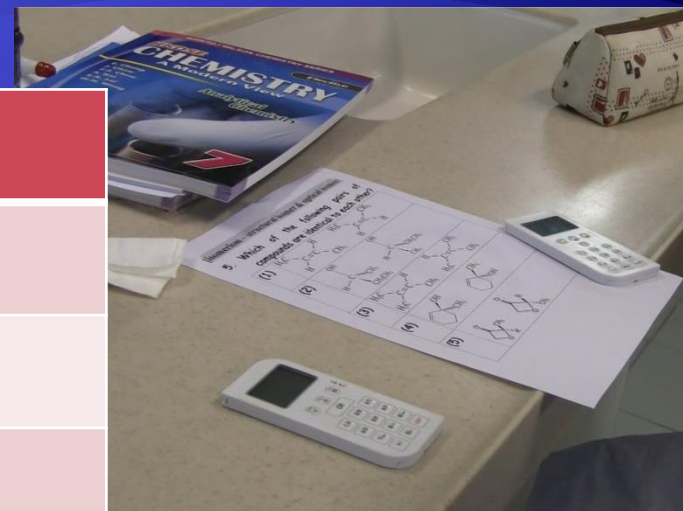
*5 questions are the same for the 2 classes



School B & C – Score on 6 Questions*

School B (30 students)	School C (24 students)
10 (33%)	10 (42%)
8 (27%)	9 (38%)
18 (60%)	4 (17%)
6 (20%)	6 (25%)
12 (40%)	4 (17%)
10 (33%)	18 (75%)

***6 questions are different for schools**



Sample Question 1-Chemical Structure and Properties

The identity of an element is determined by the number of its

- A. total electrons
- B. outermost shell electrons
- C. protons
- D. neutrons
- E. isotope

- ◆ (A) The difference in total number of electrons and protons determine the charge of the ion (e.g. ion with 11 p⁺ & 10 e⁻ → Na⁺).
電子和質子的總數差異確定離子的電荷（例如：鈉離子：11 p⁺ & 10 e⁻ → Na⁺）
- ◆ (B) Outermost shell electrons determine the chemical properties of that element (i.e. willingness to donate or accept electrons)
最外層殼電子數目確定該元素的化學特性(即願意捐出或接受電子的程度)
- ◆ (C) Elements in Periodic Table is arranged according to the Atomic Number, which is equivalent to the number of protons in the nucleus.
元素在元素週期表中的次序，是根據原子核中的質子數被編排成。
- ◆ (D) Number of neutrons determines the isotopes of the same element.
中子的數量用來區分同一元素的同位素
- ◆ (E) Number of isotopes is not the way to differentiate different elements.
同位素的數量不是用來區分不同的元素。

- ◆ (A) The difference in total number of electrons and protons determine the charge of the ion (e.g. ion with 11 p⁺ & 10 e⁻ → Na⁺).
電子和質子的總數差異確定離子的電荷（例如：鈉離子：11 p⁺ & 10 e⁻ → Na⁺）
- ◆ (B) Outermost shell electrons determine the chemical properties of that element (i.e. willingness to donate or accept electrons)
最外層殼電子數目確定該元素的化學特性(即願意捐出或接受電子的程度)
- ◆ (C) Elements in Periodic Table is arranged according to the Atomic Number, which is equivalent to the number of protons in the nucleus.
元素在元素週期表中的次序，是根據原子核中的質子數被編排成。
- ◆ (D) Number of neutrons determines the isotopes of the same element.
中子的數量用來區分同一元素的同位素
- ◆ (E) Number of isotopes is not the way to differentiate different elements.
同位素的數量不是用來區分不同的元素。

Sample Question 2-Chemical Structure and Properties

Comparing the elements in the second period of the Periodic Table, from **lithium to fluorine**, which of the following statements is/are correct?

- (1) They show a gradual change from having metallic property to having non-metallic property.
 - (2) They show a gradual increase in the number of electron shells in their atoms.
 - (3) They show a gradual decrease in melting point.
- A. (1) only
 - B. (2) only
 - C. (1) and (3) only
 - D. (2) and (3) only
 - E. All of the above

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18																	
1 1 H Hydrogen 1.00794																	2 2 He Helium 4.002602
3 3 Li Lithium 6.941	4 4 Be Beryllium 9.012182											5 5 B Boron 10.811	6 6 C Carbon 12.0107	7 7 N Nitrogen 14.0067	8 8 O Oxygen 15.9994	9 9 F Fluorine 18.9984032	10 10 Ne Neon 20.1797
11 11 Na Sodium 22.98976928	12 12 Mg Magnesium 24.3050											13 13 Al Aluminium 26.9815386	14 14 Si Silicon 28.0855	15 15 P Phosphorus 30.973762	16 16 S Sulfur 32.065	17 17 Cl Chlorine 35.453	18 18 Ar Argon 39.948
19 19 K Potassium 39.0983	20 20 Ca Calcium 40.078	21 21 Sc Scandium 44.955912	22 22 Ti Titanium 47.88	23 23 V Vanadium 50.9415	24 24 Cr Chromium 51.9961	25 25 Mn Manganese 54.938045	26 26 Fe Iron 55.845	27 27 Co Cobalt 58.933195	28 28 Ni Nickel 58.6934	29 29 Cu Copper 63.546	30 30 Zn Zinc 65.38	31 31 Ga Gallium 69.723	32 32 Ge Germanium 72.64	33 33 As Arsenic 74.9216	34 34 Se Selenium 78.96	35 35 Br Bromine 79.904	36 36 Kr Krypton 83.80

C	Solid
Hg	Liquid
H	Gas
Rf	Unknown

Metals						Nonmetals	
Alkali metals	Alkaline earth metals	Lanthanoids	Transition metals	Poor metals	Other nonmetals	Noble gases	
		Actinoids					

Sample Question 2-Chemical Structure and Properties

Comparing the elements in the second period of the Periodic Table, from lithium to fluorine, which of the following statements is/are correct?

- (1) They show a gradual change from having metallic property to having non-metallic property.
- (2) They show a gradual increase in the number of electron shells in their atoms.
- (3) They show a gradual decrease in melting point.

A. (1) only

B. (2) only

C. (1) and (3) only

D. (2) and (3) only

E. All of the above

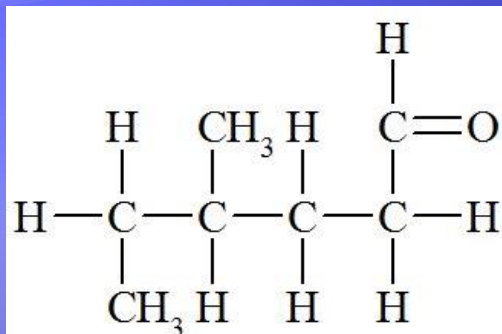
Ans: (1) Li & Be (metal); B, C, N, O & F (non-metal)

(2) they are having same number of electron shell. Li-2,1; F-2,7.

(3) m.p.: Li(180°C); Be(1287°C); B(2075°C); C(3825°C); N(-210°C);
O(-218°C); F(-219°C)

Sample Question 3-Organic Chemistry

An organic compound has the following structure:

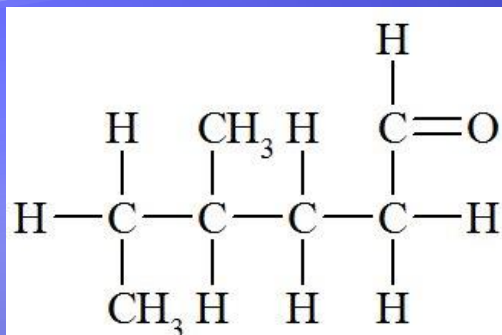


Which of the following is the systematic name of the this compound?

- A. 4,5-dimethylpentanal
- B. 1,2-dimethylpentanal
- C. 3,4-dimethylbutanal
- D. 1,2-dimethylbutanal
- E. 4-methylhexanal

Sample Question 3-Organic Chemistry

An organic compound has the following structure:



Which of the following is the systematic name of the this compound?

- A. 4,5-dimethylpentanal
- B. 1,2-dimethylpentanal
- C. 3,4-dimethylbutanal
- D. 1,2-dimethylbutanal
- E. 4-methylhexanal

◆ Students' statistics

Example 1

Question 2

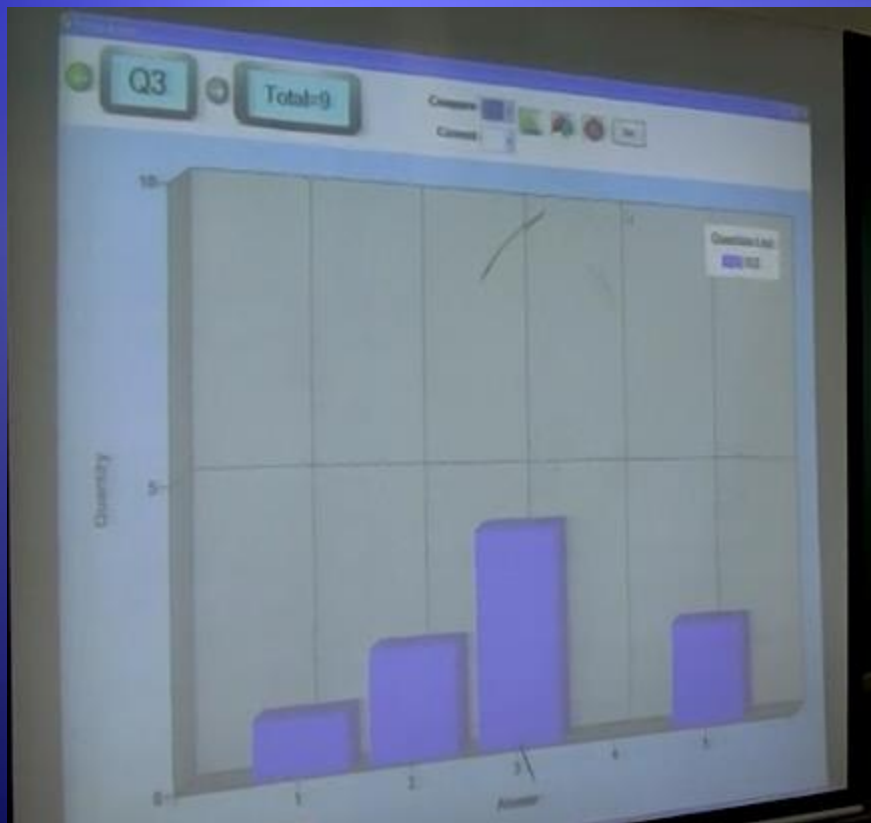
The identity of an element is determined by the number of its

- A. Total electrons
- B. Outermost shell electrons
- C. Protons
- D. Neutrons
- E. Isotope

Explanation

Sample students' statistics

1st vote

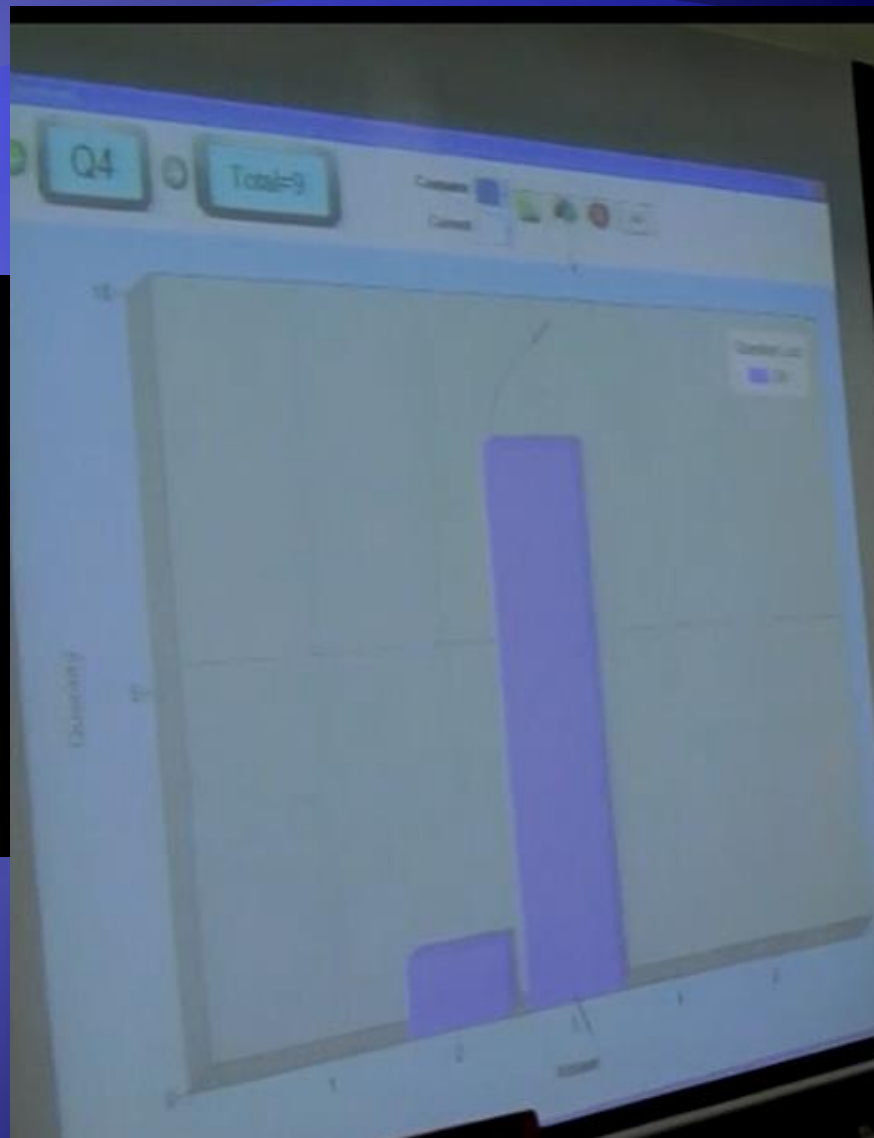


- (A) electrons
- (B) outmost shell electrons
- (C) protons
- (D) neutrons
- (E) isotopes

Sample students' statistics

2nd vote

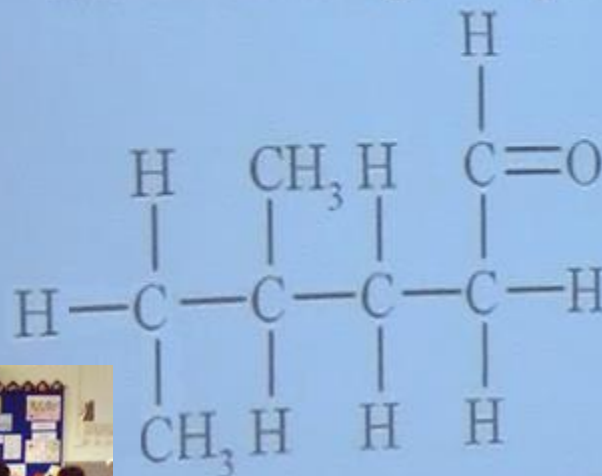
- ◆ (A) electrons
- ◆ (B) outmost shell e^-
- ◆ (C) protons
- ◆ (D) neutrons
- ◆ (E) isotopes



Example 2

An organic compound has the following structure:

Which of the following is the systematic name of the following compound?



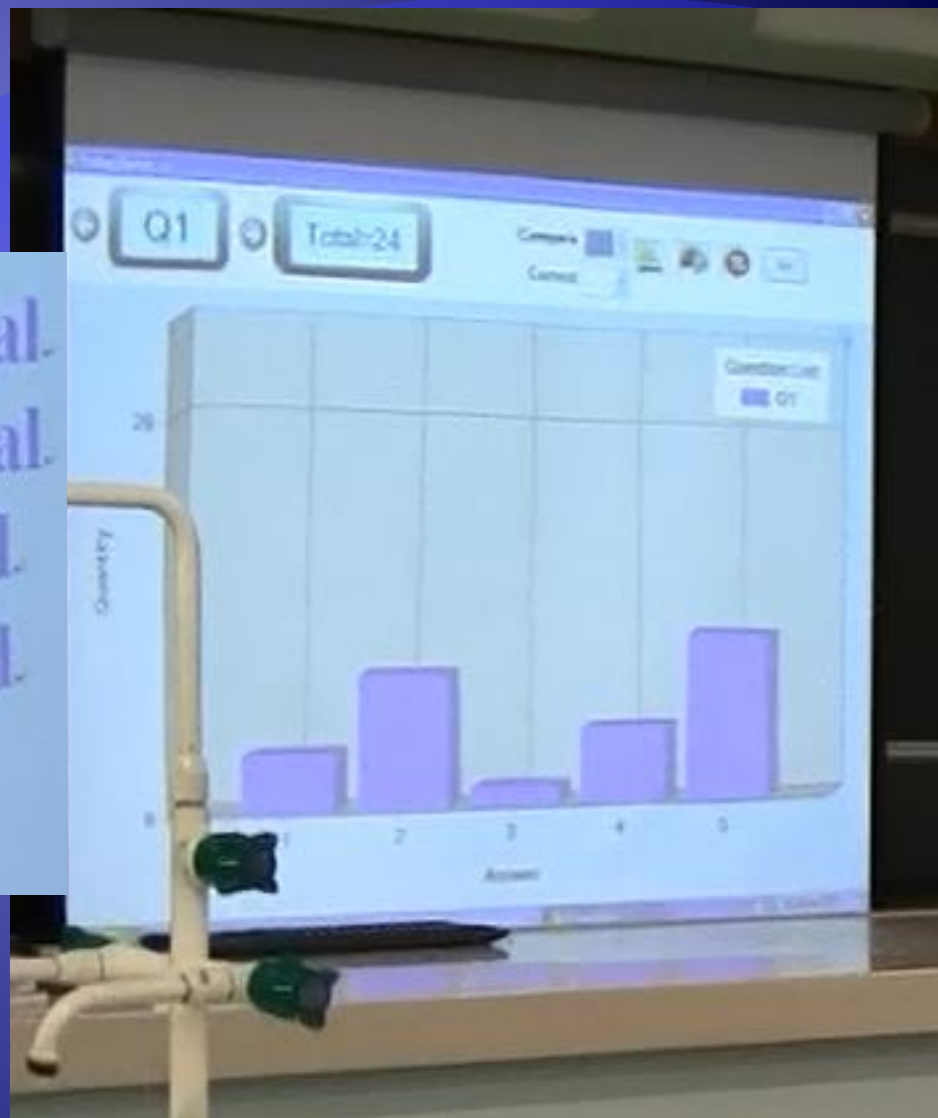
- (1) 4,5-dimethylpentanal.
- (2) 1,2-dimethylpentanal.
- (3) 3,4-dimethylbutanal.
- (4) 1,2-dimethylbutanal.
- (5) 4-methylhexanal.



sample students' statistics

◆ 1st vote

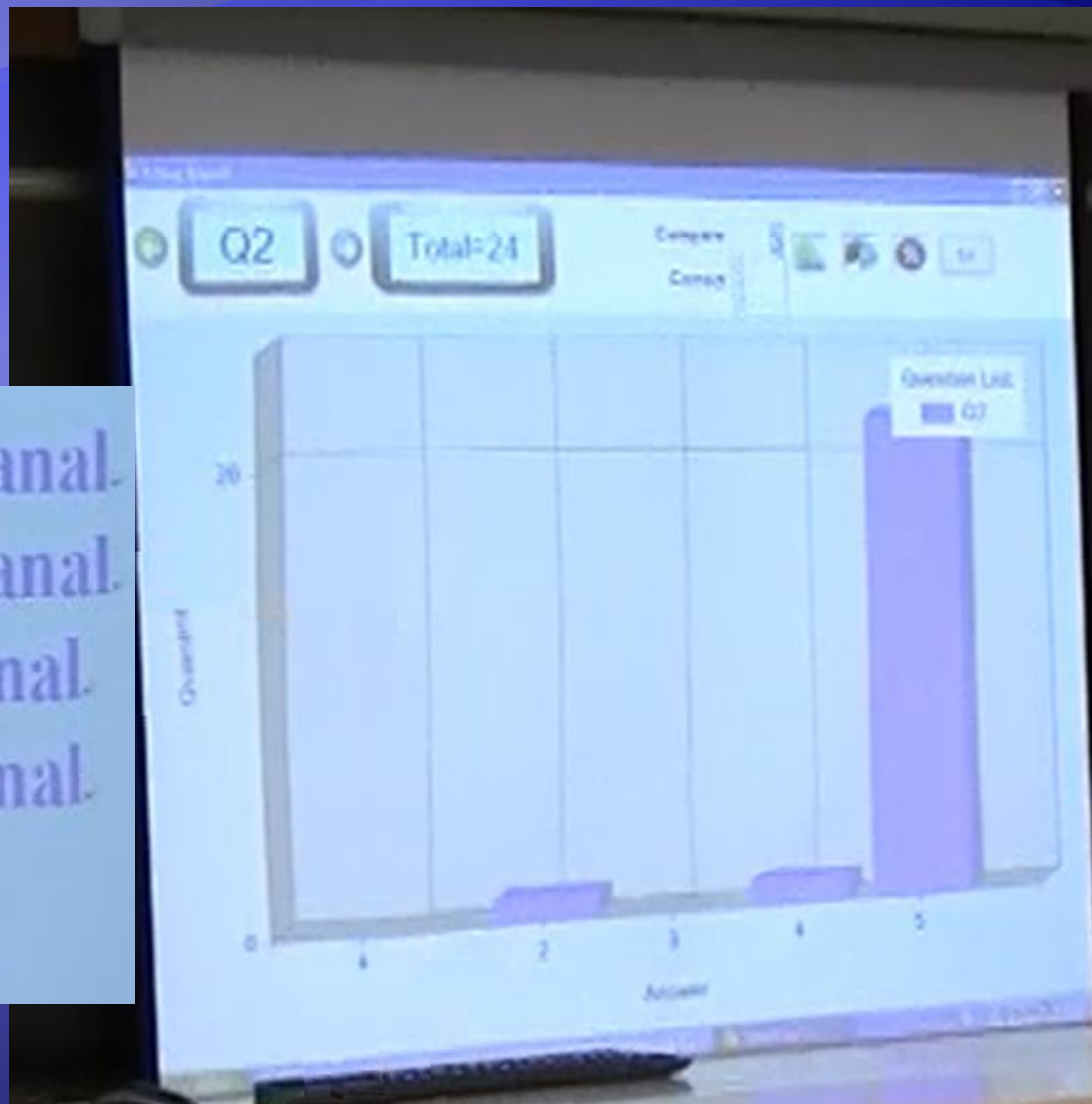
- (1) 4,5-dimethylpentanal.
- (2) 1,2-dimethylpentanal.
- (3) 3,4-dimethylbutanal.
- (4) 1,2-dimethylbutanal.
- (5) 4-methylhexanal.



sample students' statistics

◆ 2nd vote

- (1) 4,5-dimethylpentanal.
- (2) 1,2-dimethylpentanal.
- (3) 3,4-dimethylbutanal.
- (4) 1,2-dimethylbutanal.
- (5) 4-methylhexanal.





香港科技大學

THE HONG KONG UNIVERSITY OF
SCIENCE AND TECHNOLOGY

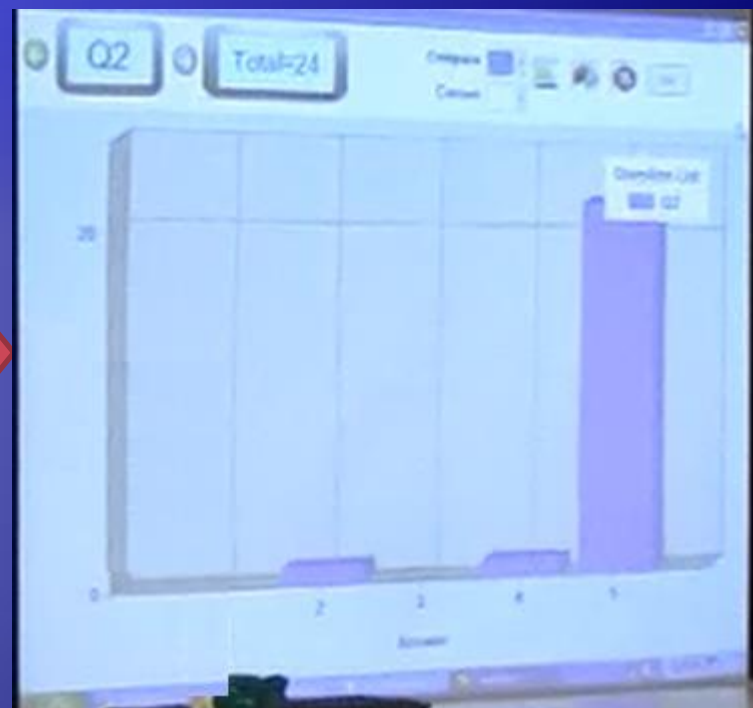
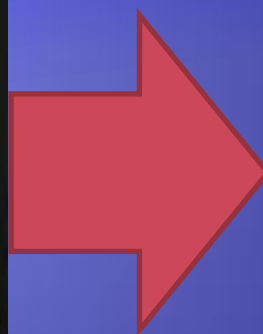
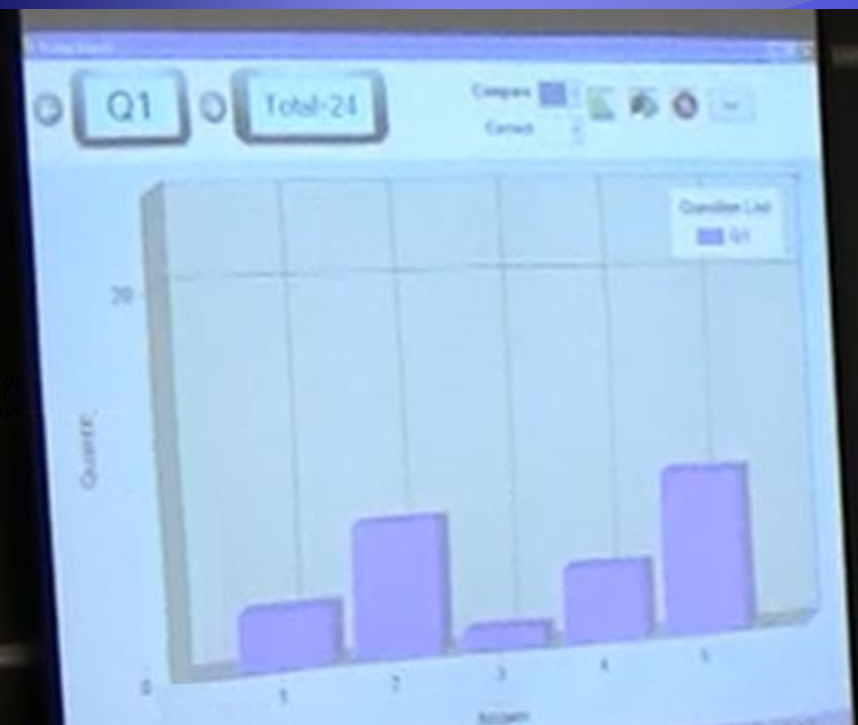
Tryout lessons in local **OBSERVATIONS AND FINDINGS**

Improve student learning by Immediate feedback

- ◆ Immediately knowing students' learning progress
- ◆ Immediate correction of students' misconception

Student survey

Characteristics	School A	School B	School C
Teacher more clear about student progress	91.6%	73.7%	51.7%
	CRS gave us a channel to tell the teachers what we did and didn't know. 課堂反饋系統讓我們有渠道告訴老師所知道的或不知道的。		
Individual student knows student progress	91.6%	84.2%	74.2%
	the real-time feedback through the bar-chart helped me to understand more about my learning. 系統給予的即時統計結果讓我更明白自己的學習		



Encourage participation

- ◆ Encourage participation - esp. passive students
- ◆ Synchronized discussion (managing diversity)
- ◆ Immediately knowing the level of participation

Student survey

Characteristics	School A	School B	School C
Improve motivation and engagement	70-80%	>70%	70-90%
	I became more engaged. 我在課堂中更投入參與。 it enhanced my motivation to learn. 我更有動機去學習。 using CRS is better than hand-raising in responding to teacher's questions. 使用課堂反饋系統較以舉手來回答老師的問題更優勝。		
Improve attention	87.5%	68.4%	77.4%
	I became more attentive in class. 我更專心學習。		



Dept of Chemistry, HKUST

Encourage students' thinking

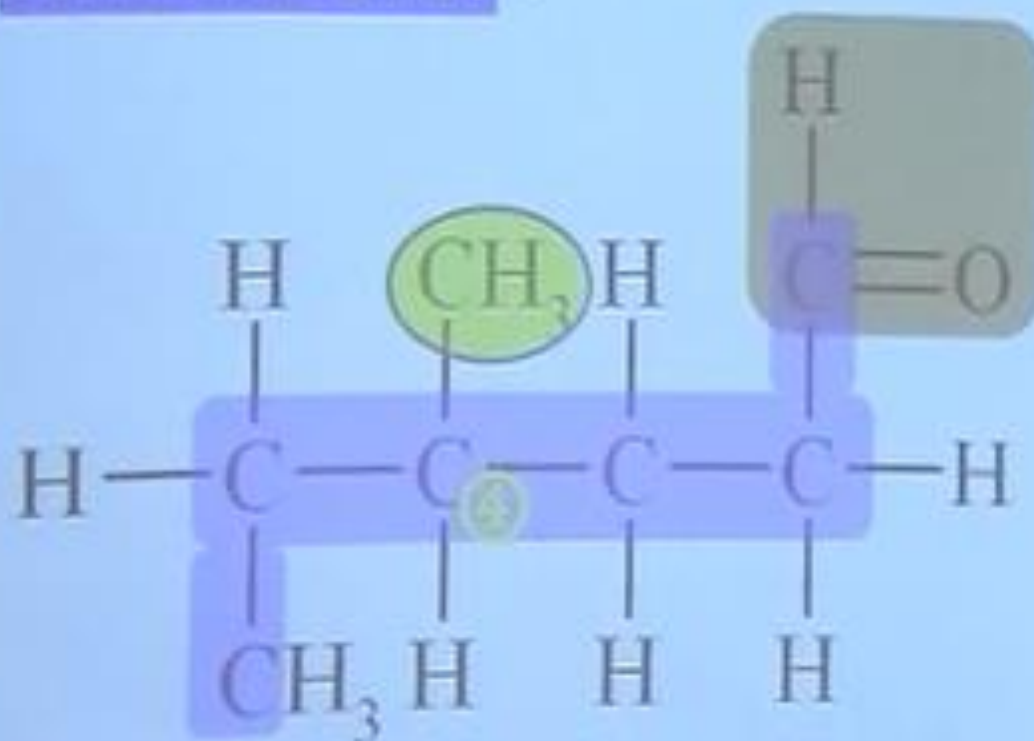
- ◆ Longer time for serious thinking
- ◆ Clarifying concepts (by knowing others' thinking process)

Student survey

Characteristics	School A	School B	School C
Thinking more seriously	95.8%	84.2%	77.5%
	I seriously thought about my answer to the question. 回答時我會認真地思考。		
Help to clarify concept	91.7%	79.0%	74.2%
	CRS together with the assessment items clarified my understanding in concepts of Chemistry. 使用課堂反饋系統及所附問題讓我更清晰理解化學科的概念。		

◆ Other observations

Option (5): 4-methylhexanal
correct ans.





A close-up of a teacher pointing at a large screen displaying a chemical structure and a bar chart. The screen shows a chemical structure of a branched aldehyde with the text "化合物具有以下的結構" and "這是這化合物的系統名稱". To the right, a bar chart titled "Quantity" shows two bars, one at 1 and one at 2. The chart is labeled "Q3" and "Total=31".

Chemical structure shown: CC(C)C=O (2-methylpropanal)

Text on screen: 化合物具有以下的結構, 這是這化合物的系統名稱

Bar chart data:

Quantity	Count
1	20
2	11

