

Board of Studies
Report for Teachers

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Chemistry

CAT 1: Structured questions

GENERAL COMMENTS

The reaccredited study design was more useful due to its improved clarity. As in past years, the criteria were used as a checklist by the setting panel to ensure that the criteria were all tested by the questions presented.

The following marking scheme is essentially the one used by the assessors of CAT 1. Where appropriate, some comment has been appended. General v. performance on this paper was fairly even.

SPECIFIC INFORMATION

Question-by-question details of student responses

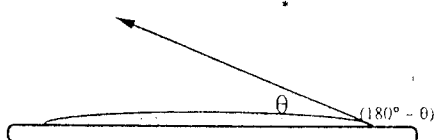
An asterisk indicates that one mark was received for that response.

Question 1

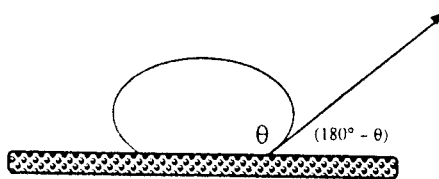
1 C	6 D	11 C	16 C
2 B	7 C	12 A	17 B
3 B	8 D	13 A	18 B
4 B	9 D	14 A	
5 A	10 B	15 D	

Question 2

- a. -3-
i.



- ii. Note that the angle* defined as the contact angle above is as given in 'Chemistry 2'. You must also accept the angle defined as the supplement of the above.
- iii. zero or 'extremely small'*. If the contact angle in the diagram drawn by the student is the supplement of the contact angle defined here, then the correct response would be '180°' or 'close to 180°'.
- b. -2- *for correct shaped drop.
* $\theta > 90^\circ$ (note that if θ has been defined as the supplement of the conventional definition, the correct response is $\theta < 90^\circ$)



- c. -4- *Water in Oil,*
i. ~~*Oil in water.~~
*High conductivity would have required that the Na^+ & Cl^- were able to travel through the solution. Since this is not occurring, emulsion cannot be oil in water.
- ii. *for indicating the relative positions of the oil and the water

phases by labelling at least one of them.
 *for indicating the correct relative orientation of the hydrophilic and hydrophobic parts of the surface active agent in the surface of the emulsion particle.

(3 + 2 + 4 = 9 marks)

Question 3

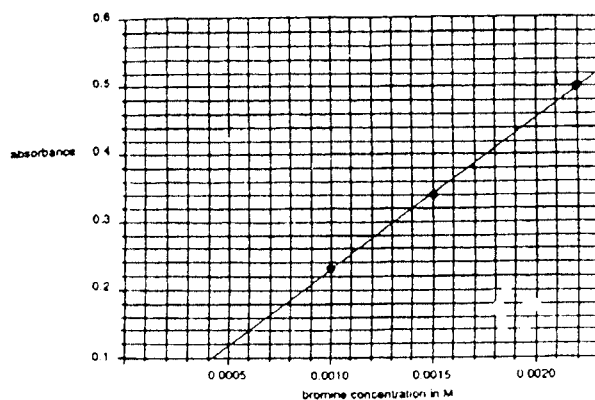
a. -2-

- *To separate the light from the light source into its component wavelengths (or frequencies).
- *To detect the intensity of the light arriving.

b. -2-

For correctly plotting all three points. *For sketching or ruling a straight line through the points. A curve resulting from incorrectly plotted points may be given one mark if the error is not gross – judgment here!

Many students obviously felt bound to draw the line through the (0, 0.1) point with they took to be the 'origin'. That mistake cost a mark, even though they might well get the right answer by their interpolation.



c. -1-

0.00117 M* (accept in the range 0.00115 – 0.00120)

Question 4

a. -5-

- *[O₂] = 0.040 M
 *[SO₂] = 0.080 M
 *[SO₃] = 0.020 M

$$\text{ii. } \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 [\text{O}_2]} *$$

$$\text{iii. } \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 [\text{O}_2]} = \frac{0.020}{0.080 \times 0.040} = 1.6 * \text{M}^{-1}$$

Give credit here if a correct numerical result is calculated from an incorrect equilibrium expression. This mark is for correct substitution and arithmetic.

b. -1-

*5 minutes

c. -2-

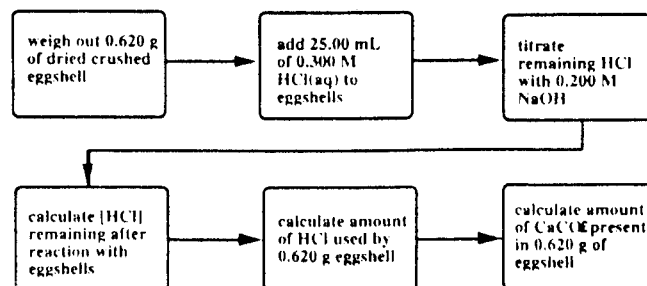
More O₂ has been added*, hence reaction moves to the right, converting some SO₂ to SO₃*.

d. -4-

- Higher pressure is not needed since *conversion is close to complete at 450°C
- *K at 450°C > K at 600°C (due to negative ΔH) hence better conversion at 450°C.
 *Combination of rate and equilibrium factors lead to *optimum conditions for formation at 450°C.

Question 5

a. -2-



Give half-mark for each box added up to $4 \times \frac{1}{2} = **$. The information in the second and third boxes is essential for 1 mark, plus another two reasonable choices to make up the second mark. Round odd half-marks down.

Nothing special went wrong here although a significant number of students suggested 'dissolving the the eggshell in water'.

b. -2-

Give half-mark for each item added up to $4 \times \frac{1}{2} = **$. The list must include:

Balance; 25.00 mL pipette (volume need not be specified); burette; conical flask or beaker. (If one of these is missing, the odd one could be made up with one of spatula; indicator; funnel.) Round odd half-marks up.

c. -1-

Give half-mark for each item added up to $2 \times \frac{1}{2} = *$ Any two of: Lab. coat; safety glasses; long hair tied back; no thongs; no smoking ... Round an odd half-mark down.

d. -7-

$$\text{i. } \frac{25.00}{1000} \times 0.300 = 0.0075 \text{ mole of HCl}*$$

$$\text{ii. } \frac{18.2}{1000} \times 0.200 = 0.00364 \text{ mole of NaOH used}*$$

iii. 0.00364 mole* (Give credit if this response is the same as under ii., even if ii. was wrong.)

$$\text{iv. } 0.0075 - 0.0034 = 0.00386 \text{ mole}*$$

v. 0.00193 mole* (Give credit if this response is one half the value shown in iv., even if iv. was wrong.)

vi. $0.00193 \times 100 = 0.193 \text{ g CaCO}_3*$ (note that 100 g mol⁻¹ is the molar mass of CaCO₃.)

$$\% \text{ CaCO}_3 \text{ by mass is } \frac{0.193}{0.620} \times 100 = 31.1\%*$$

Generally this calculation was well done.

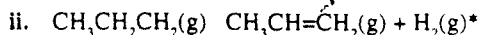
Question 6

a. -1-

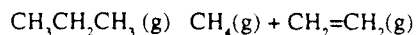
To separate crude oil into its components according to their differing volatilities (boiling points, molar masses would be acceptable)*

b. -7-

i. Has a carbon – carbon double bond.*

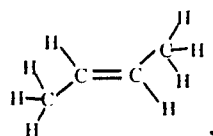
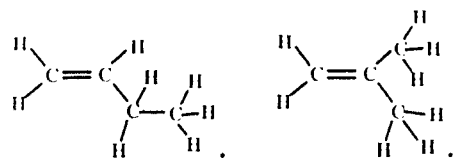


or



iii. Forms SO_2^* .

iv. Give one mark for knowing that the formula of the alkene with four carbon atoms is C_4H_8^* . Then one for each correct structure:



There is no need to show the cis-trans isomerisation of the third structure shown – this is not required by the Study Structure.

Question 7

a. -2-

i. To carry or sweep the sample being analysed through the column*.

ii. To bring about a separation of a mixture into its components*.

b. -4-

Butanol – D; ethanol – B; methanol – A; propanol – C.

** for the correct sequence. No marks for any incorrect sequence. mark each for an incomplete sequence with no response in an incorrect position. In this case, with an odd mark, round up.

Interaction with stationary phase increases with increasing molar mass*, hence molecules will emerge in the order of increasing molar mass*.

Some students confused this with a mass spectrometer apparently – peak B was often assigned to the alcohol with the greatest molar mass, C to propanol & so on down the line....

c. -1-

*for any *one* of the following:

- longer column
- more strongly absorbing stationary phase
- lower flow rate of carrier gas

'Report for Teachers' series of pamphlets contain reports from Chief Assessors and State Reviewers for the common assessment tasks undertaken in 1995. Each report contains an overview of student performance on individual CATs.

Chief Assessors and State Reviewers have commented on such matters as the assessment criteria and student performance on the CATs.

Users of these reports should be aware that these reports are for 1995 CATs. Changes may have been made to study designs, CATs and assessment criteria since the completion of the reports.