

只限教師參閱

FOR TEACHERS' USE ONLY

香港考試及評核局

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

2012年香港中學文憑

HONG KONG DIPLOMA OF SECONDARY EDUCATION 2012

**CHEMISTRY PAPER 1 & COMBINED SCIENCE (CHEMISTRY)
SECTION B**

MARKING SCHEME

本評卷參考乃香港考試及評核局專為今年本科考試而編寫，供閱卷員參考之用。閱卷員在完成閱卷工作後，若將本評卷參考提供其任教會考班的本科同事參閱，本局不表反對，但須切記，在任何情況下均不得容許本評卷參考落入學生手中。學生若索閱或求取此等文件，閱卷員/教師應嚴詞拒絕，因學生極可能將評卷參考視為標準答案，以致但知硬背死記，活剝生吞。這種落伍的學習態度，既不符現代教育原則，亦有違考試着重理解能力與運用技巧之旨。因此，本局籲請各閱卷員/教師通力合作，堅守上述原則。

This marking scheme has been prepared by the Hong Kong Examinations and Assessment Authority for markers' reference. The Authority has no objection to markers sharing it, after the completion of marking, with colleagues who are teaching the subject. However, under no circumstances should it be given to students because they are likely to regard it as a set of model answers. Markers/teachers should therefore firmly resist students' requests for access to this document. Our examinations emphasise the testing of understanding, the practical application of knowledge and the use of processing skills. Hence the use of model answers, or anything else which encourages rote memorisation, should be considered outmoded and pedagogically unsound. The Authority is counting on the co-operation of markers/teachers in this regard.



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INSTRUCTIONS TO MARKERS

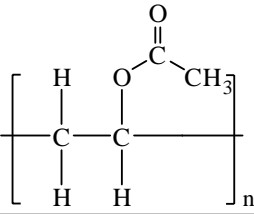
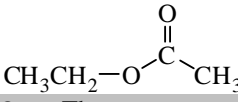
1. In order to maintain a uniform standard in marking, markers should adhere to the marking scheme agreed at the markers' meeting.
2. The marking scheme may not exhaust all possible answers for each question. Markers should exercise their professional discretion and judgment in accepting alternative answers that are not in the marking scheme but are correct and well reasoned.
3. The following symbols are used:

/	A single slash indicates an acceptable alternative within an answer.
*	Step-mark (for questions involving calculations)
†	Correct spelling required

4. In questions asking for a specified number of reasons or examples etc. and a candidate gives more than the required number, the extra answers should not be marked. For instance, in a question asking candidates to provide two examples, and if a candidate gives three answers, only the first two should be marked.
5. Award zero marks for answers which are contradictory.
6. Chemical equations should be balanced except those in reaction schemes for organic synthesis. For energetics, the chemical equations given should include the correct state symbols of the chemical species involved.
7. In the question paper, questions which assess candidates' communication skills are marked with an asterisk (*). For these questions, the mark for effective communication (1 mark per question) will be awarded if candidates can produce reasonable answers using complete sentences which are easily understandable.

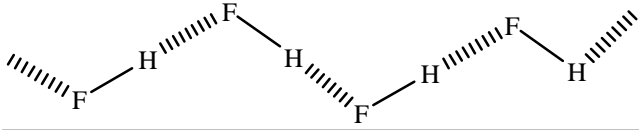
Part I

Marks

1. (a) Atoms with the same number of protons but different numbers of neutrons. / Atoms with the same atomic number but different mass numbers. (Accept giving the answer with a specific example. E.g. All neon atoms have 10 protons, but they can have 10, 11 or 12 neutrons. NOT Accept ions, elements and molecules.) 1
- (b) $20 \times 0.9048 + 21 \times 0.0027 + 22 \times 0.0925$ 1
 $= 20.19 / 20.2 / 20.188 / 20.1877$ 1
- (c) Gas for filling luminous advertisement tubes / neon tubes / neon signs / neon lights (NOT Accept fluorescent tubes) 1
- (d) Neon is monoatomic whereas oxygen is diatomic. O₂ molecule has larger molecular size than Ne molecule. (NOT Accept larger molecular mass). 1
 Thus stronger van der Waals' force / stronger intermolecular force among O₂ molecules. (NOT Accept VDW force) 1
2. (a) (i) Cracking (†) / Catalytic cracking (†) / Thermal cracking (†) 1
- (ii) This process can produce small molecules / alkenes / ethene / petrol / hydrocarbons of lower molecular masses from large hydrocarbons to meet the industrial demand / to make useful materials / to make useful fuels. / This process can produce more small molecules / alkenes / ethene / petrol / hydrocarbons of lower molecular masses from large hydrocarbons. 1
- (b)  1
- CH₂ and OC(=O)CH₃ can be written in the condensed form.
 - The brackets and "n" SHOULD NOT be omitted.
- (c) (i)  1
- The ester group should not be written in the condensed form. CH₃COOCH₂CH₃ is NOT acceptable.
 - The bond angle of the ester group NOT necessary be drawn as 120°
- (ii) Bromine test – ethenyl ethanoate can decolourise orange / brown / yellow bromine / Br₂ solution immediately while ethyl ethanoate cannot. (NOT Accept Br). (Require to mention the reaction of Br₂ with ethenyl ethanoate is much faster than ethyl ethanoate) / Treating with acidified potassium permanganate solution - ethenyl ethanoate can decolourise purple acidified potassium permanganate solution while ethyl ethanoate cannot. (Also accept treating with potassium permanganate solution (without acidification) with the correct descriptions of observations – change from purple to brown (ppt)). 1+1

†: correct spelling

3. (a) Provide H^+ / ions / electrolyte for the chemical cell. 1
- (b) Copper, Metal Y, Metal X / **Cu, Y, X** 1
- (c) (i) $X \rightarrow X^{2+} + 2e^-$ 1
- (ii) $2H^+ + 2e^- \rightarrow H_2$ 1
- (d) No, the metal Y strip would be the negative electrode. It is because silver is lower than copper in the electrochemical series / silver is less reactive than copper. So silver should be lower than Y in the electrochemical series / less reactive than Y. 1

4.  1
- The drawing should show at least TWO HF molecules.
 - Should show complete HF molecules.
 - Should indicate the hydrogen bonds by dashed lines.
 - Each H atom can only form one hydrogen bond.
 - F-H-F angle not necessary be drawn as 180° in the drawing.

Fluorine / F is a highly /very electronegative element. 1

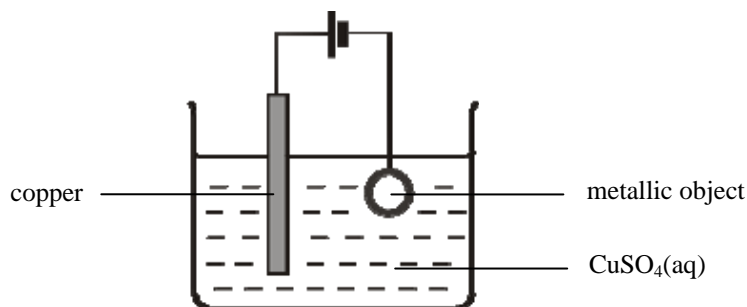
The H-F covalent bond is very /highly polar / The H-F molecule is highly polarized. 1

(For CS:

- (a) (gas) syringe (†) 1
- (b) Initial rate = $60/4 = 15 \text{ cm}^3/\text{min}$ ($0.25 \text{ cm}^3/\text{s}$) (Accept 14.8 – 15.2) 1
- (c) Initial rate is not the same as the average rate because the slope of the curve is not a constant / the slope of the curve is decreasing / the slope of the curve and the slope of the tangent are different. (Accept comparison of rates calculated from the curve and tangent shown in the graph.) 1
5. (a) Displacement reaction occurred when the iron rod is dipped into the copper(II) sulphate solution. / Some copper(II) ions (Cu^{2+}) are reduced and deposited onto the surface of the iron rod as copper metal. 1
- $Cu^{2+}(aq) + Fe(s) \rightarrow Cu(s) + Fe^{2+}(aq)$ / $CuSO_4(aq) + Fe(s) \rightarrow Cu(s) + FeSO_4(aq)$ (Not accept $CuSO_4 \cdot 5H_2O$; physical states are not required.) 1
- (b) (i) Copper is lower than hydrogen in the electrochemical series / Cu^{2+} is discharged preferentially than H^+ when a current is applied. 1
- (ii) Hydrogen gas / H_2 1
- The hydrogen gas bubbles hinder the deposition of copper on the surface of the metallic object, hence causing the copper metal deposited easily flaked off. 1

†: correct spelling

5. (c)



3

Correct overall diagram – 1 mark

Correct labels (copper, object (accept omitting the object), $\text{CuSO}_4(\text{aq})/\text{Cu}^{2+}(\text{aq})$) - 1 mark

Correct direction of the battery / power supply – 1 mark

- Label not accept $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

6. • Dissolve solid lead(II) nitrate in water, 1
- Then mix with (excess) sulphuric acid / K_2SO_4 / Na_2SO_4 solution. (Also accept other examples of soluble sulphates) (**Remark:** if the candidate considered PbSO_4 as soluble salt – 0 mark for this part). 1
- Filter the mixture to obtain the residue (PbSO_4), wash it with deionised water and then dry in oven. 1
- Communication Mark 1
 (Chemical knowledge = 0 or 1: no communication mark
 Chemical knowledge = 2 or 3: for easily understandable complete sentences, communication mark = 1, otherwise = 0)

7. (a) $\text{NH}_4^+ + \text{OH}^- \rightarrow \text{NH}_3 + \text{H}_2\text{O}$ (Neglect physical state) 1
 (NOT Accept: $\text{NH}_4\text{NO}_3 + \text{OH}^- \rightarrow \text{NH}_3 + \text{NO}_3^- + \text{H}_2\text{O}$)
- (b) The KOH is (very) corrosive. / NH_4NO_3 is explosive / NH_4NO_3 is flammable / HCl is corrosive. 1
 (Should specify the chemical; NOT Accept harmful / toxic / poisonous; NOT Accept HCl Fume is corrosive as dilute HCl is involved.)
- (c) Prevent sucking back as $\text{NH}_3(\text{g})$ is very soluble. (Accept prevent HCl sucking upwards or similar descriptions) / Increase the surface area for dissolving $\text{NH}_3(\text{g})$ 1
- (d) (i) pipette (†) 1
- (ii) Changes from red to orange. (NOT Accept red to yellow). 1
- (iii) Number of moles of HCl(aq) remained in the beaker : 1*
 $= \frac{0.100 \times 0.04100 \times (100.00 \div 25.00)}{1} = \mathbf{0.0164}$
- Number of moles of $\text{NH}_3(\text{g})$ produced 1*
 $= 0.0485 - \mathbf{0.0164} = 0.0321$
- Percentage by mass of NH_4NO_3 in the fertiliser 1
 $= \frac{(0.0321 \times 80)}{3.150} \times 100\% = 81.5\%$ / 81.5
 (Accept 81.52% / 82.5% / 82.54%)
- (e) Flame test – gives a lilac / purple / light purple flame. (Not Accept deep purple and violet) 1
8. (a) CO_2 gas produced makes the bread rise / spongy / soft. 1
- (b) $2 \text{KHCO}_3 \rightarrow \text{K}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$ / $\text{KHCO}_3 \rightarrow \frac{1}{2} \text{K}_2\text{CO}_3 + \frac{1}{2} \text{H}_2\text{O} + \frac{1}{2} \text{CO}_2$ 1
- (c) (i) $q = 27.5 \times 4.3 \times (25.8 - 20.2) = 662.2 \text{ J}$ 1*
 $\Delta H = +662.2 \times 10^{-3} \div (3.39 / 100.1) = +19.6 \text{ kJ mol}^{-1}$ / +19.55 kJ mol^{-1} / +19.5 kJ mol^{-1} 1
 (the unit must be correct)
- (ii) $\Delta H = \frac{19.6 - (-49.1 \times \frac{1}{2})}{1} / \frac{1}{2}((+19.6 \times 2) - (-49.1))$ 1*
 $= +44.15 \text{ kJ mol}^{-1}$ (Accept +44.1 to +44.2 kJ mol^{-1}) (the unit must be correct) 1
- (d) (i) $\Delta H = \frac{1}{2}(-1146 - 394 - 286 - (-959 \times 2)) = +46 \text{ kJ mol}^{-1}$ (the unit must be correct) 1
- (ii) Not performing the experiment in standard conditions. / Heat transfer with the surroundings. / The heat capacity of the container was neglected. 1

(Remark for 8(c)(i), 8(c)(ii) and 8(d)(i))

1. If the candidate omitted the “+” sign for the positive numbers, and the numerical answers are correct, deduct 1 mark only.)

2. If the units given in 8(c)(i), 8(c)(ii) and 8(d)(i) are wrong, but they are the same, deduct 1 mark only. If those incorrect units are not the same in each questions, marks are deducted individually.

* step mark

†: correct spelling

9. (a) Blue / Blue and pink colouration would be observed near the iron nail which rusts. (Accept green to blue / yellow to blue) 1
- (b) Both iron nail B and iron nail C would not rust. 1
For iron nail B, as Mg is higher than iron in the metal reactivity series (with further explanation such as: the magnesium ribbon loses electrons more readily and will become Mg^{2+} / Mg corrodes more readily). / 1
For iron nail B, the magnesium ribbon protects the iron nail from rusting by sacrificial protection. 1
For iron nail C, as it is sealed with grease, the iron cannot contact with water and / or air (oxygen), so rusting cannot occur.
- Give two correct explanations without referring to the corresponding iron nails – 1 mark
10. (Any three) 3
- Install catalytic converters in car
 - Use unleaded petrol
 - Replace diesel with LPG for vehicles / Use LPG for vehicles/mini-bus/bus/taxi
 - Install scrubbers in power plant
 - Using Ultra Low Sulphur Diesel / Use low sulphur coal in power plant / use low sulphur fuels.
 - Use electrostatic precipitator
 - Remove dust by mechanical filtering
- (NOT accept use less fossil fuels / use alternative fuels)

Part II

Marks

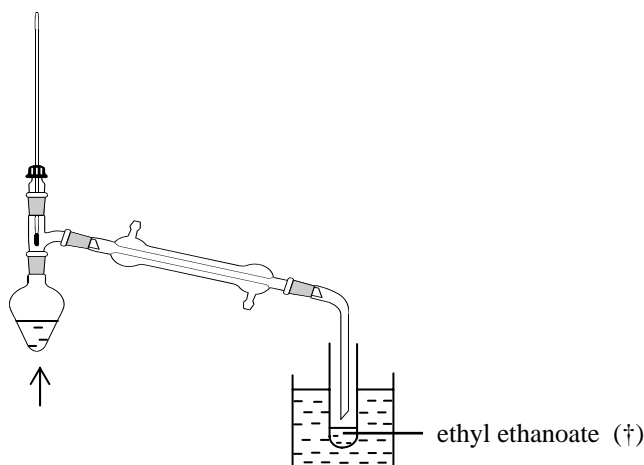
11. (a) Initial rate = $60/4 = 15 \text{ cm}^3/\text{min}$ (0.25 cm³/s) (Accept 14.8 – 15.2) 1
- (b) HCl is a monobasic acid, while H₂SO₄ is a dibasic acid. Initial rate increases if H₂SO₄ is used. 1
 / Initial rate increases as the concentration of H⁺ increases in 2.0 M H₂SO₄.
 Therefore, the frequency of effective collisions increases.
- (c) No. of mol of Zn = $2/65.4 = 0.031 \text{ mol}$ 1*
 Vol of H₂ formed = 0.031×24000 1*
 = $734 \text{ cm}^3 / 0.734 \text{ dm}^3$ (Accept 730-744 cm³ / 0.73-0.74 dm³) 1
 (the unit must be correct)

12. (a)  1

- The bond angles of the alkene should be about 120°. The bonds drawn in 90° are not accepted.

- (b) Cinnamaldehyde is a non-polar compound which can dissolve in a relatively non-polar organic solvent like ethyl ethanoate. However, water is a polar solvent. / 1
 Both cinnamaldehyde and ethyl ethanoate are relatively non-polar compounds. Their molecules are attracted by weak intermolecular forces. / weak dipole-dipole interactions / van der Waals' forces.

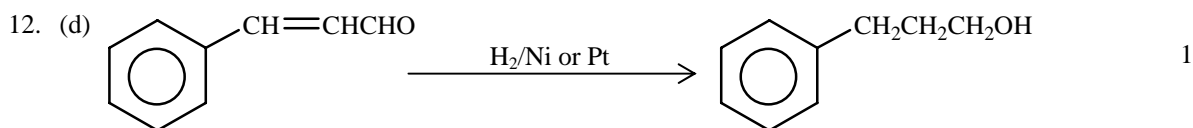
- (c) 2



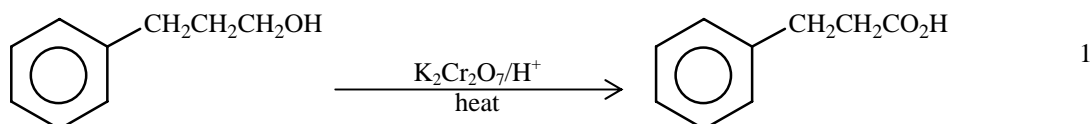
- 1 mark is given to the drawing of the correct setup
- No mark will be given to the drawing if:
 - The thermometer or the condenser is missing
 - The setup is a closed system
 - The top of the distillation head is open to air
 - A fractional column is included in the drawing
- 1 mark is given to the correct labeling and spelling of the distillate (ethyl ethanoate)

*: step mark

†: correct spelling

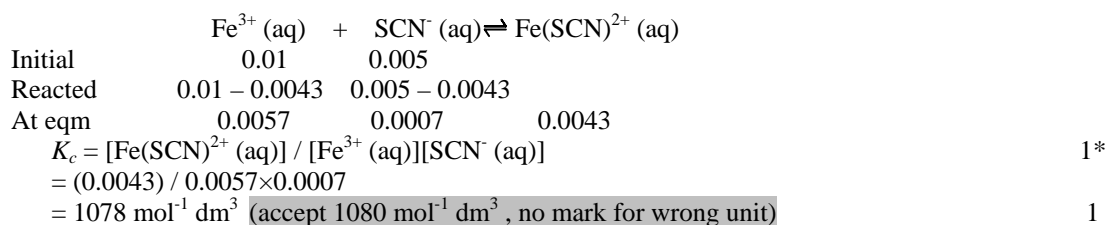
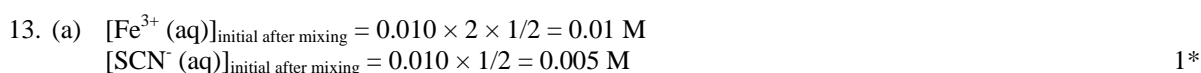


(Accept the aldehyde group (CHO) is NOT reduced by H₂/catalyst to give CH₂OH)



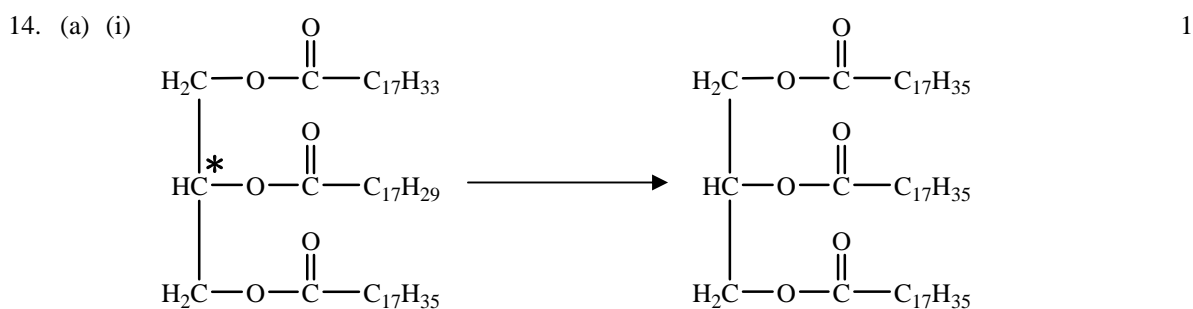
(Accept other correct answers.)

- If the candidate gave more than three steps, only the first three steps will be marked.
- If a reaction/an intermediate is incorrect, it will not affect the marking of the subsequent steps as long as the chemistry of the subsequent steps is correct.



- For the 2nd step mark:
 Correct expression for K_c – 1 mark
 No expression is written, the numbers in “(0.0043) / 0.0057 × 0.0007” is correct – 1 mark
 No expression, the numbers in “(0.0043) / 0.0057 × 0.0007” is incorrect – 0 mark

(b) The equilibrium position will shift to the left hand side / reactant side. 1



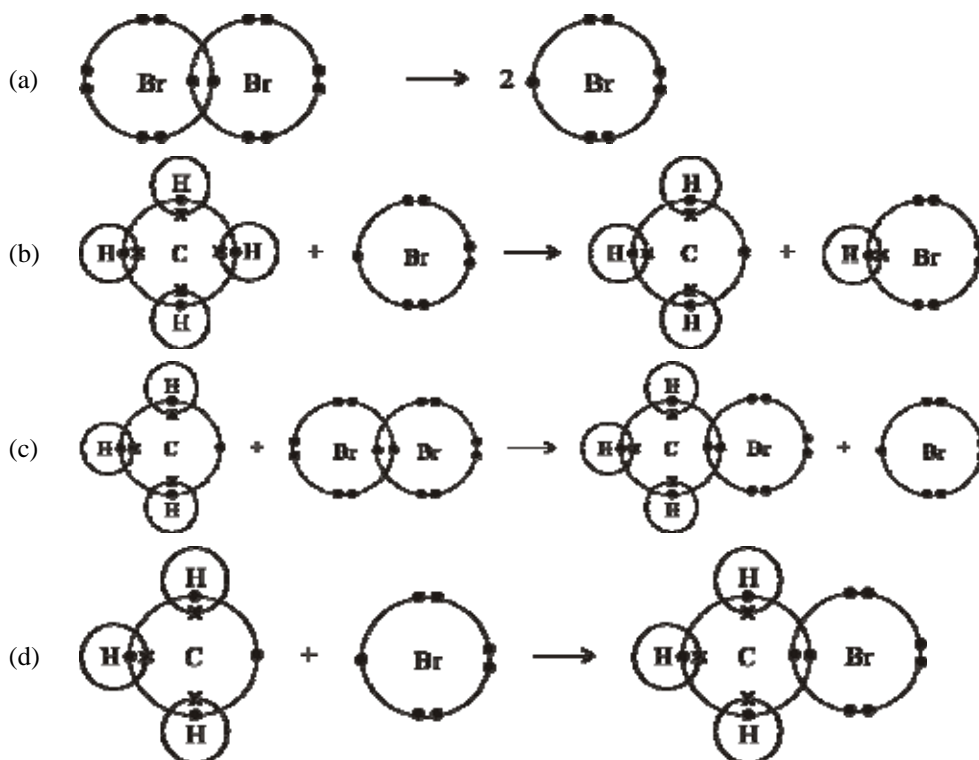
(ii) Yes. X has one chiral carbon and hence optically active, while Y does not has chiral carbons and hence optically inactive. Thus, there is a change in optical activity for the conversion. 1

*: step mark

14. (b) The $C_{17}H_{35}COO^-$ ion has an ionic head (COO^-) and a hydrocarbon tail ($C_{17}H_{35}$).
 The hydrocarbon tail dissolves in grease droplets / is hydrophobic while the ionic head dissolves in water / is hydrophilic.
 The ionic heads of the grease droplets repel from each other and the dirt inside these droplets are then removed.
 Communication Mark
 (Chemical knowledge = 0 or 1: no communication mark
 Chemical knowledge = 2 or 3: for easily understandable complete sentences, communication mark = 1, otherwise = 0)

1
1
1
1

15.



(a), (b), (c) OR

(a), (b), (d)

1+1+1
(1+1+1)

- No marks are given if the numbers of electrons in the outermost shells are wrong.
- If more than three equations are written, marks are given to the correct ones (Max = 3).
- If the candidate used the wrong halogen atoms (F, Cl, I) in the drawing, deduct 1 mark

16. (a) Na_2O , MgO , Al_2O_3
 (Order is not important. 0 mark if more/less than these 3 oxides are listed.)
- (b) SiO_2 has a giant covalent structure, and the Si and O atoms are linked by strong covalent bonds. (Not accept strong covalent structure / giant covalent bonds)
 Other covalent oxides are discrete molecules attracted by weak van der Waals' forces / weak intermolecular forces / weak dipolar interactions. (NOT accept VDW forces)
- (c) $Al_2O_3 + 2 OH^- + 3 H_2O \rightarrow 2 Al(OH)_4^-$
 or $Al_2O_3 + 2 NaOH + 3 H_2O \rightarrow 2 NaAl(OH)_4$

1
1
1
1