



Exampro GCSE Chemistry

C2 Chapter 4 Higher

Name:

Class:

Author:

Date:

Time: 59

Marks: 59

Comments:

Q1. The picture shows a lump of phosphate rock.



Rob Lavinsky, iRocks.com – CC-BY-SA-3.0 [CC-BY-SA-3.0], via Wikimedia Commons

Phosphoric acid is made by adding sulfuric acid to phosphate rock.

- (a) The rate of reaction between sulfuric acid and phosphate rock can be increased if the mixture is heated to a higher temperature.

Explain, in terms of particles, why an increase in temperature increases the rate of reaction.

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.....

(2)

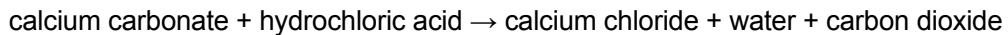
- (b) State **one** other way in which the rate of reaction between sulfuric acid and phosphate rock can be increased.

.....
.....

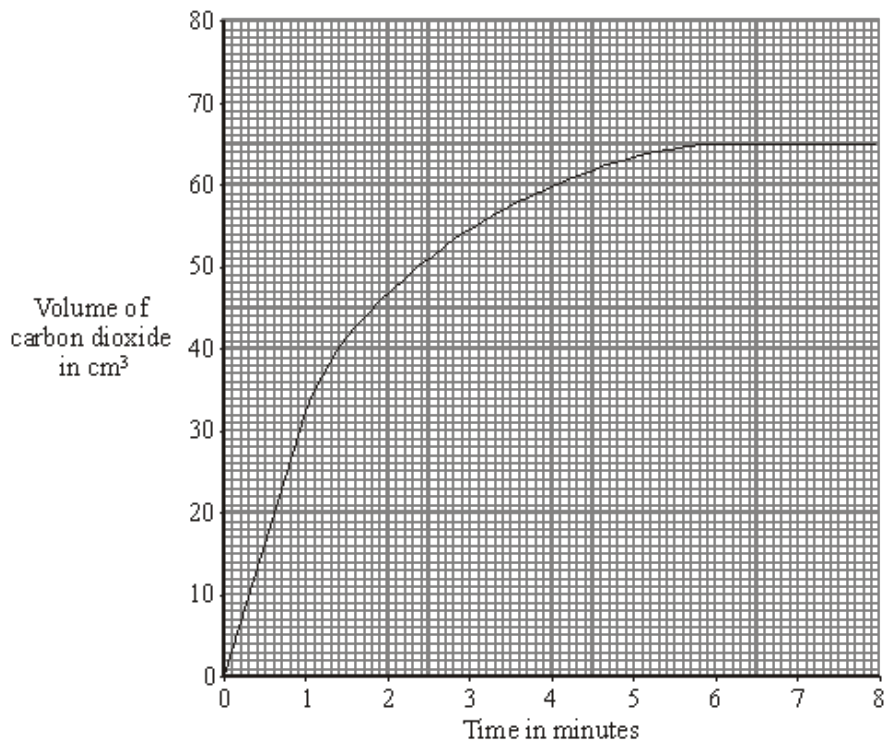
(1)

(Total 3 marks)

Q2. A student studied the reaction between dilute hydrochloric acid and an **excess** of calcium carbonate.



The student measured the volume of carbon dioxide produced in the experiment. The results are shown on the graph.



(a) After how many minutes had all the acid been used up?

..... minutes

(1)

(b) The student wrote this conclusion for the experiment:

'The reaction gets slower and slower as the time increases.'

Explain why the reaction gets slower. Your answer should be in terms of particles.

.....
.....
.....
.....

(2)

- (c) A second experiment was carried out at a higher temperature. All other factors were the same.

Draw a line on the graph above to show the results that you would expect.

(2)
(Total 5 marks)

Q3. Hydrogen peroxide, H_2O_2 , is often used as a bleach. It decomposes forming water and oxygen.

- (a) (i) Write the balanced chemical equation for the decomposition of hydrogen peroxide.

.....

(3)

- (ii) Give a test for oxygen.

Test

Result of test

.....

(2)

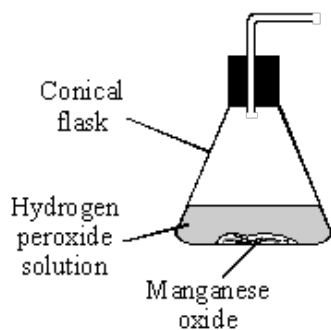
- (b) The rate of decomposition of hydrogen peroxide at room temperature is very slow. Manganese oxide is a catalyst which can be used to speed up the decomposition. Complete the sentence.

A catalyst is a substance which speeds up a chemical reaction. At the end of the reaction, the catalyst is

(1)

- (c) Two experiments were carried out to test if the amount of manganese oxide, MnO_2 affected the rate at which the hydrogen peroxide decomposed.

- (i) Complete the diagram to show how you could measure the volume of oxygen formed during the decomposition.

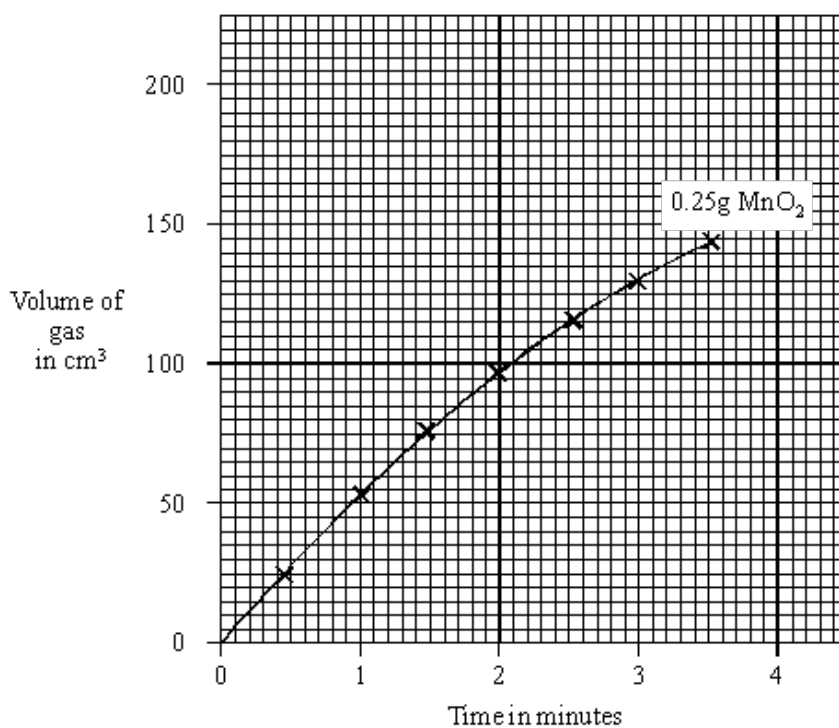


(2)

(ii) The results are shown in the table.

Time in minutes	0	0.5	1	1.5	2	2.5	3	3.5
Volume of gas in cm³ using 0.25 g MnO₂	0	29	55	77	98	116	132	144
Volume of gas in cm³ using 2.5 g MnO₂	0	45	84	118	145	162	174	182

Draw a graph of these results. The graph for 0.25 g MnO₂ has been drawn for you.



(3)

(iii) Explain why the slopes of the graphs become less steep during the reaction.

.....

(2)

(iv) The same volume and concentration of hydrogen peroxide solution was used for both experiments. What **two** other factors must be kept the same to make it a fair test?

1

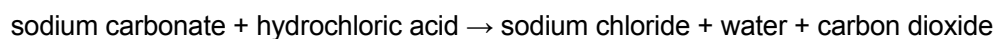
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2

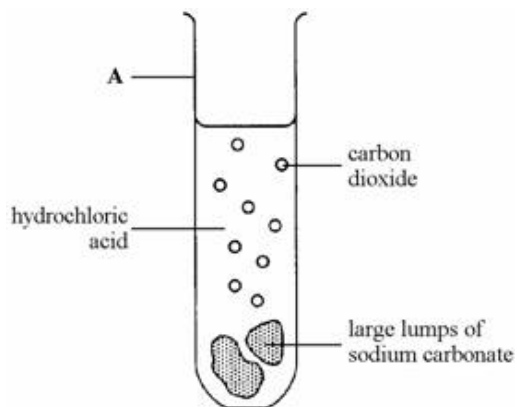
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(2)
(Total 15 marks)

Q4. Dilute hydrochloric acid reacts with sodium carbonate. The word equation for this reaction is:



(a) The diagram shows apparatus used by student X to investigate this reaction.



(i) Name the piece of apparatus labelled A.

.....

(1)

(ii) NaCO_3 NaCl Na_2CO_3 Na_2Cl

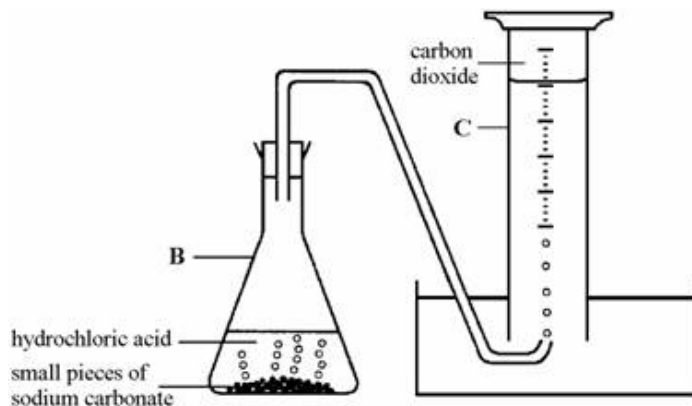
Use the Data Sheet to help you choose the correct formula from the list for:

sodium carbonate,

sodium chloride.

(2)

- (b) The diagram below shows a different apparatus used by student Y to investigate the same reaction.



- (i) Name the pieces of apparatus labelled **B** and **C**.

B

C

(2)

- (ii) Both students X and Y used the same

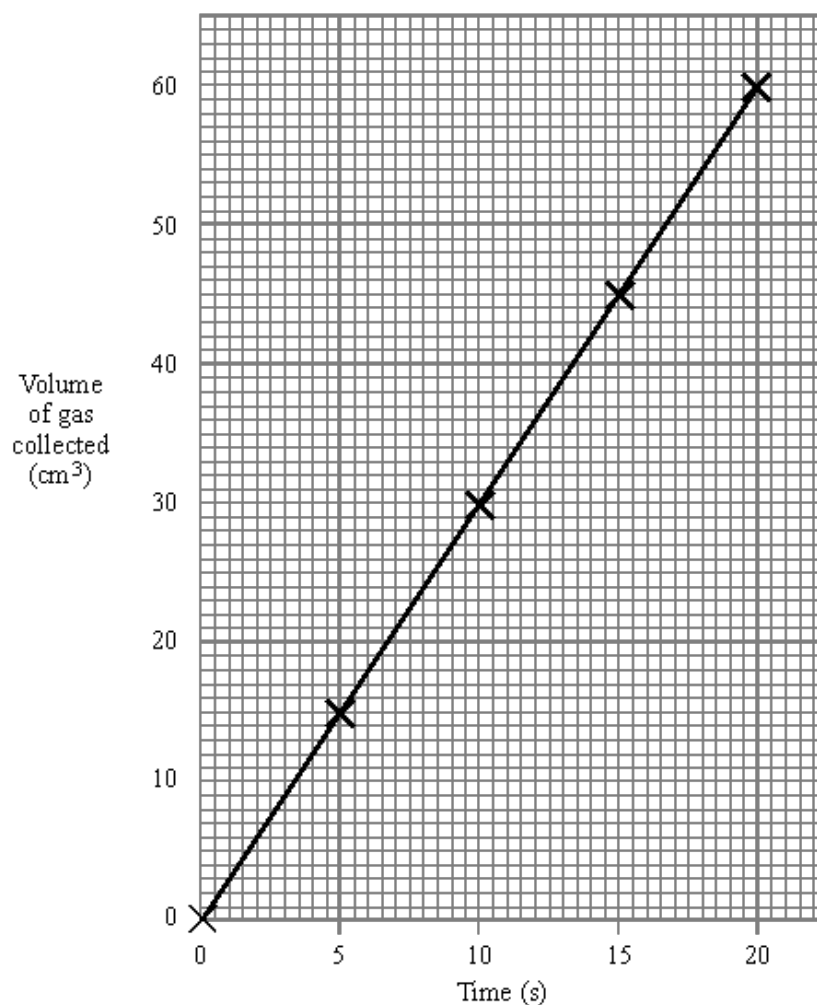
- volume of acid
- concentration of acid
- temperature
- mass of sodium carbonate

Use information from the diagrams to explain why the reaction that student Y carried out was faster.

.....
.....
.....

(2)

(c) The results obtained by student Y were plotted as shown below.



(i) Student Y repeated the experiment exactly as before but used warmer acid. This made the reaction faster.
On the graph draw a line for this faster reaction.

(2)

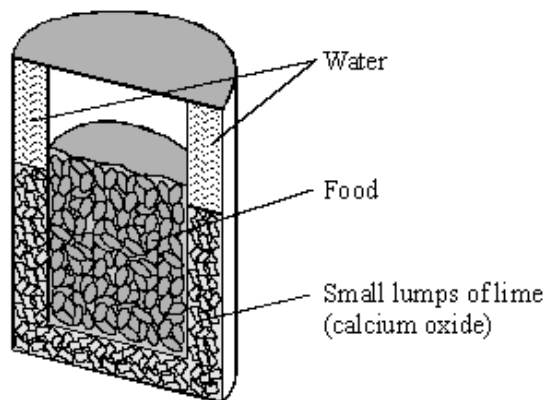
(ii) Explain, in terms of particles, why the rate of the reaction is faster when warmer acid is used.

.....
.....
.....

(3)

(Total 12 marks)

Q5. Mountaineers can warm their food in self-heating, sealed containers.



(a) The water is allowed to react with the lime. The heat from the reaction warms the food. What type of reaction causes a rise in temperature?

.....

(1)

(b) Some students investigated the effect of adding different sized lumps of lime to water. The results of their investigation are shown.

Time in minutes	Temperature in °C		
	Large lumps of lime	Small lumps of lime	Powdered lime
0	18	18	18
1	19	20	28
2	21	23	43
3	24	27	63
4	28	32	88
5	33	38	100

What do these results show? Give an explanation for your answer.

.....

(2)

(c) Suggest and explain **one** disadvantage of using powdered lime to heat food.

.....
.....
.....

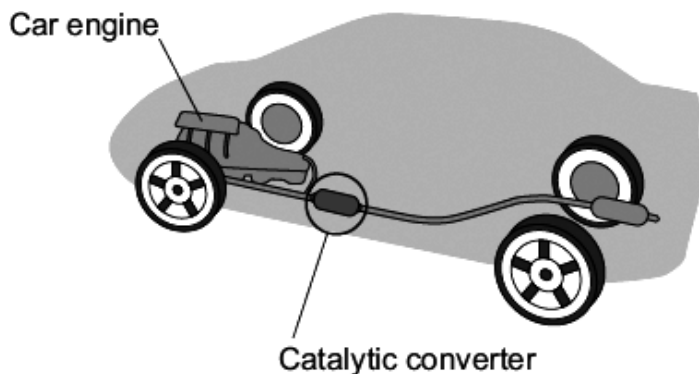
(2)
(Total 5 marks)

Q6. Read the information about car engines.

Burning petrol in air is an *exothermic* reaction. This reaction is used in car engines.

When petrol burns it produces harmful substances such as nitrogen oxides and carbon monoxide.

A catalytic converter stops these harmful substances being released into the air.

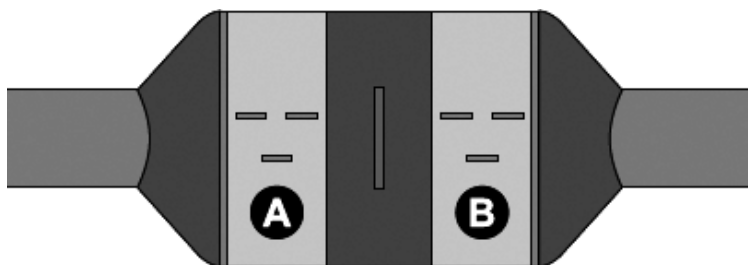


(a) The reaction is *exothermic*. What is the meaning of *exothermic*?

.....
.....

(1)

(b) The catalytic converter has two parts shown as **A** and **B** in the diagram.



Part **A** contains a catalyst made from platinum and rhodium.

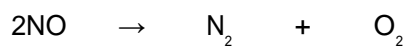
Part **B** contains a catalyst made from platinum and palladium.

(i) Why are catalysts used in chemical reactions?

.....
.....

(1)

(ii) One reaction in part **A** is shown by this equation.



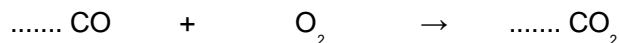
Suggest why this reaction helps the environment.

.....
.....

(1)

(iii) The equation for one of the reactions in part **B** is shown below.

Balance this equation.



(1)

(iv) The catalytic converter works for many years without replacing the catalyst.

Explain why the catalyst does not need to be replaced.

.....
.....

(1)

(v) Suggest why different catalysts are used in parts **A** and **B**.

.....
.....

(1)

- (c) Modern catalytic converters contain nanosized particles of catalyst. Using nanosized particles reduces the cost of the catalytic converter.

Suggest and explain why the use of nanosized catalyst particles reduces the cost of the catalytic converter.

Your answer should include information about the size and surface area of the particles.

.....

.....

.....

.....

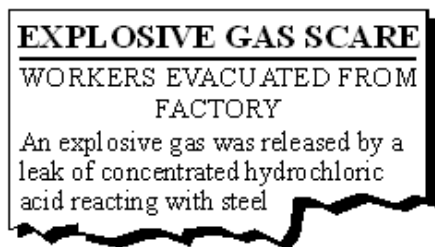
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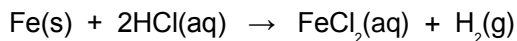
.....

(3)
(Total 9 marks)

- Q7. This article appeared in a newspaper.



- (a) The balanced chemical equation shows the reaction between steel and hydrochloric acid.



- (i) Which metal in steel reacted with the hydrochloric acid?

.....

(1)

- (ii) The gas released was described as explosive. Explain why.

.....

.....

.....

.....

.....

(3)

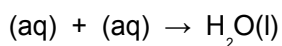
(b) In the factory hydrogen chloride is manufactured by reacting hydrogen with chlorine. Hydrochloric acid is formed when hydrogen chloride forms a solution in water.

(i) Water was sprayed on the steel and hydrochloric acid. This slowed the rate of reaction. Explain why.

.....
.....
.....
.....

(2)

(ii) It would have been better to neutralise the acid with an alkali rather than to just add water. Hydrochloric acid can be neutralised by reaction with sodium hydroxide. Complete the ionic equation for the neutralisation reaction.



(2)

(iii) In the factory the acid leak was neutralised with slaked lime, $\text{Ca}(\text{OH})_2$, and not sodium hydroxide, NaOH . Suggest why.

.....
.....
.....
.....
.....

(2)

(Total 10 marks)

M1. (a) particles move faster
accept molecules / atoms / ions instead of particles

or
particles have more energy
ignore move / vibrate more

1

so they collide more often / frequently
allow particles collide harder / with more force
ignore collide quicker

or
more of the collisions are successful / have the activation energy
ignore collide more / more collisions

1

- (b) any **one** from:
- increase surface area (of the rock)
accept crush / powder the rock
 - increase the concentration (of the acid)
ignore increase the pressure / temperature
 - add a catalyst
 - stir / mix the mixture
- 1

[3]

M2. (a) 6
accept 5.8 – 6

1

(b) hydrochloric acid used up / reacted / combined / **or** fewer particles
(of hydrochloric acid) **or** fewer hydrogen ions owtte

accept reactants used up
*accept less calcium carbonate **or***
smaller surface area of calcium carbonate
accept lower concentration / less crowded
*do **not** accept atoms / molecules*
ignore references to energy
*do **not** accept references to atoms or molecules*

1

fewer collisions owtte
independent mark

1

- (c) steeper curve initially
independent marks 1
- levels out at same volume
- *must indicate levelling out*
 - *if line goes higher than 66 do **not** award this mark*
 - *diagonal line only = 0 marks*
 - *if steeper initially and then crosses the line and finishes correctly, then loses one*
- 1

[5]

- M3.** (a) (i) H_2O_2 reactant correct
ignore any state symbols 1
- $\text{H}_2\text{O} + \text{O}_2$ products correct 1
- $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ balanced
accept correct multiple 1
- (ii) glowing splint 1
- relights
accept 'bursts into flame'
*do **not** accept a lighted splint burns brighter **or** faster* 1
- (b) unchanged
*accept **not** used up **or** left (behind)* 1
- (c) (i) gas syringe **or** measuring cylinder **either** with scale drawn **or** labelled 1
- the apparatus as drawn would work 1
- (ii) correct plotting of points
***one** mark to be deducted for each error* 2
- best fit graph line drawn (single line drawn) 1

(iii) concentration of hydrogen peroxide decreases
accept less particles of hydrogen peroxide to collide
*do **not** accept hydrogen peroxide gets used up*

1

rate of reaction decreases
accept reaction gets slower

1

(iv) any two from:

- temperature
- pressure
- division of catalyst **or** manganese oxide
*do **not** accept any other factors*

2

[15]

M4. (a) (i) test tube / boiling tube
for 1 mark

1

(ii) Na_2CO_3
NaCl
each for 1 mark

2

(b) (i) flask
measuring cylinder
each for 1 mark

2

(ii) used smaller pieces
gains 1 mark
but larger surface area for reaction
gains 2 marks

2

(c) (i) steeper line
straight line
each for 1 mark

2

- (ii) reaction occurs when particles collide
 higher temperature, higher speed of particles
 so harder collisions
 more frequent collisions
any three for 1 mark each

3

[12]

M5. (a) exothermic (reaction)

1

- (b) smaller lumps react faster
or larger lumps react slower

*accept smaller lumps cause a more rapid rise in temperature **or**
 vice versa*

*do **not** accept higher temperature
or more heat unless linked to time*

1

smaller lumps have a larger surface (area) or larger lumps have a smaller
surface (area)

*more water can react at the same time
or so less water can react at the same time*

1

- (c) heats up (too) rapidly

accept temperature (too) high

1

burning the food **or** the hands

*accept danger of container exploding **or** splitting **or** food
 overheating*

do not accept reference to handling of powder

*do **not** accept a lot of powder needed **or** powder getting into food **or**
 too hot to eat **or** food would not cook properly **or** heat through
 properly*

1

[5]

M6. (a) gives out heat / energy

allow release / loses

allow the products have less energy

or

energy / heat transferred to the surroundings

ignore temperature rises

*allow more energy given out in forming bonds than taken in to
 break bonds*

1

- (b) (i) speed up the reaction (owtte)
accept changes the rate
accept lowers activation energy
accept increases successful collisions
accept allows reaction to take place at a lower temperature 1
- (ii) nitrogen (N₂) / oxygen (O₂) / products are safe **or** not harmful / pollutant /
toxic / dangerous / damaging
ignore releases nitrogen / oxygen unless qualified
- or**
- (harmful) nitrogen monoxide / NO is not released into the air.
accept prevents / less acid rain
ignore greenhouse gas / ozone layer 1
- (iii) 2 and 2
accept correct multiples or fractions 1
- (iv) idea of catalyst not being used up
allow not changed by reaction
ignore catalyst does not take part
ignore catalyst not used in the reaction 1
- (v) idea of different reactions (require different catalysts)
accept catalysts work for specific reactions
allow different gases 1
- (c) • smaller / very small / or any indication of very small / 1–100 nanometres /
a few (hundred) atoms
ignore just small
ignore size of the converter 1
- big(ger) surface area 1
- less (catalyst) needed / small amount of catalyst needed 1

[9]

- M7.** (a) (i) iron **must** be named
do **not** accept Fe 1

- (ii) hydrogen 1
- and oxygen mixtures 1
- burn rapidly 1
- (b) (i) lowers concentration
accept dilutes the acid
*do **not** accept cooling* 1
- less collisions (between particles) 1
- (ii) H^+ (aq)
accept H_3O^+ only if 2 in front of H_2O 1
- OH^- (aq)
if spectator ions correctly included on both sides, maximum = 1 mark 1
- (iii) $Ca(OH)_2$ weak alkali
accept NaOH strong alkali 1
- $Ca(OH)_2$ causes no problems
accept NaOH causes named problem
*(eg caustic **or** exothermic **or** burns **or** corrosive)* 1

[10]

