AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.8.2 IDENTIFICATION OF COMMON GASES (PACK 1)

SCORE	PERCENTAGE
/61	%

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Q1.

(a) damp / moist litmus paper

ignore colour of litmus paper

1

bleaches / goes white

1

(b) forward and reverse rates equal

1

because no escape of reactants or products

allow closed system
allow particles for reactants or products

1

(c) equilibrium shifts

allow no longer in equilibrium

1

to right-hand side

allow in favour of forward reaction

1

to produce more of any products
or
to reduce any reactants

allow correct references to Le Chatelier's Principle

1

(new) equilibrium will be established

1

(d) amount of chlorine gas increases

1

(because) system shifts to counteract the change

allow (because) system shifts to take in energy
allow (because) system shifts in endothermic direction

1

(e) no change

1

because equal numbers of molecules
or
moles (of gas) on each side

1

[12]

Q2.

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(a) limewater

allow calcium hydroxide solution

1

(which) turns cloudy / milky (when carbon dioxide is added)

must link to limewater

1

(b) **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content

- use hydrochloric acid
- place acid in suitable container e.g. beaker
- add (a spatula of) magnesium carbonate
- stir

- continue adding magnesium carbonate until in excess
- when solid remains **or** no more effervescence occurs
- filter to remove excess magnesium carbonate
- using filter paper and funnel
- pour solution into evaporating dish

- evaporate water till crystallisation point reached
- using electric heater or Bunsen burner and a water bath
- leave to cool
- until crystals form
- pour off excess water **or** filter
- dry crystals in cool oven or with filter paper

[8]

Q3.

(a) Safe to drink

1

(b) To remove undissolved solids

1

(c) the gas is chlorine / Cl_2

1

which sterilises water

1

(d) as distance between steel increases strength of concrete decreases

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1

change above and change below 1.0 cm separation is compared and described

must refer to graph values for this mark

1

[6]

Q18.

(a) black

1

(b) limewater

accept calcium hydroxide (solution)

1

[2]

Q19.

(a) (black) copper oxide formed

explanation must be linked to correct observation

1

loss in mass is due to carbon dioxide / gas production

1

limewater cloudy shows carbon dioxide produced

1

(b) (i) any **one** from:

ignore references to reactivity

- (bunsen burner flame) not hot enough (to decompose potassium carbonate)

  accept temperature not high enough (to decompose potassium carbonate)
- not all Group 1 carbonates decompose

  allow potassium is in Group 1

1

(ii) potassium carbonate:

(mass) 13.8 g

1

(limewater) colourless

accept no change for colourless

ignore clear

1

zinc carbonate:

(limewater turns) cloudy

Metal carbonate	***Mass after heating in***	***Limewater***

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	g	
Potassium carbonate	*13.8*	*colourless*
Zinc carbonate		*cloudy*

1

[7]

Q20.

(a) hydrogen

allow H_2

H must be uppercase and number a subscript

1

(b) (i) carbon dioxide

allow CO_2

letters must be uppercase and number a subscript

1

(ii) water

allow H_2O

letters must be uppercase and number a subscript ignore steam

1

(c) (i) petrol

allow petroleum / refinery gases

1

(ii) fuel (oil)

allow bitumen

1

(iii) fuels

1

(d) A → E → C → B → D

2 if in correct order

*any of following gains **1** mark if overall order is incorrect E before C*

or

C before B

2

[8]

Q21.

(a) hydrogen **and** carbon

both elements in either order needed for mark

any additional elements negates the mark

1

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(b) colourless liquid / condensation in U tube
ignore ice melts

1

(because) water produced

1

lime water goes cloudy

1

(because) carbon dioxide produced

1

[5]

Q22.

(a) (acids) react with calcium carbonate / shells

1

(so) shells will be (chemically) eroded
*do **not** allow melts*
allow dissolved / are thinner / worn away / corroded
ignore weakened / break down

1

(b) (i) calcium carbonate → calcium oxide (+ carbon dioxide)
ignore numbers and symbols

1

(ii) 22 (g)
mark answer line and ignore working

1

(iii) calcium hydroxide / limewater
ignore solution

1

[5]

Q23.

(a) **economic**

any **one** from:
- increases jobs
- more money in local economy
- increase in local trade
- more shops / businesses
- better transport links

1

environmental

any **one** from:
- future development of quarry eg to lake / reservoir
- future development to recreational area
- provides different habitat

1

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(b) calcium oxide and carbon dioxide

both products required for mark
allow CaO for calcium oxide
allow CO_2 for carbon dioxide
allow quicklime for calcium oxide

1

(thermal) decomposition

1

(c) (i) $CaO + H_2O \rightarrow Ca(OH)_2$

correct formulae
*3 correct for **2** marks*
*2 correct for **1** mark*
ignore attempts to balance equation

2

(ii) carbon dioxide

1

solution goes cloudy (then clear again)

accept milky / forms a white precipitate

1

[8]

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Q1.

(a) 53% of students achieved credit on this question. The majority of those in their response omitted to write 'damp or moist' when describing the litmus paper test. Limewater was a popular incorrect answer.

(b) 34% of students achieved any credit on this question; with 5% of responses achieving both marks. The idea of a 'closed system' was the most popular creditworthy answer.

Students described a reversible reaction, explained that the reactants changed into the products and vice versa but rarely indicated that it was the rate of these reactions that was equal. Some students gave the confused answer that 'the rate that reactants are used up is equal to the rate that the products are formed'.

(c) In this question and in parts **(d)** and **(e)**, it was apparent that, although many students could recall Le Chatelier's Principle, few were able to apply it.

23% of students achieved more than one mark on this question, with 2% of students achieving all four marks. Students (34% that achieved one mark) were able to suggest a shift in the equilibrium but often in the wrong direction: 'The equilibrium shifts to the left so that more NaClO can be formed to react with the HCl'.

Some students gave responses that discussed changes in terms of the exothermic or endothermic direction though this was not given in the stem of the question.

A simple response that 'reaction would do the opposite' because of Le Chatelier was frequently given. Very few students concluded their explanation with 'a new equilibrium would be established'.

(d) Many students answered incorrectly by explaining the effect of temperature on the rate of reaction rather than on the equilibrium. 8% of students achieved both marks. And a further 28% achieved a single mark, predominately for identifying that the amount of chlorine gas increased. 14% of students made no attempt at this question.

(e) This was a challenging question whereby 7% of students achieved any marks. Many students answered incorrectly by explaining the effect of pressure on the rate of reaction rather than on the equilibrium. Those that answered with reference to the number of molecules on each side of the equation seemed to think that 2HCl was one molecule and consequently talked of the equilibrium shifting to the left, the side with fewer molecules. Approximately 12% of students made no attempt at this question.

Q2.

Foundation

(a) 38% of students made no attempt at answering the question. Of those who did, most used a lit splint or added universal indicator with 8% of students knowing the correct test for carbon dioxide.

(b) 43% of students did not attempt this 'extended response' question on a Required Practical Activity. It was expected that students would have knowledge of the

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methods of preparing a soluble salt.

Key steps in the process were: using the correct reagents, mixing in a suitable container; adding the magnesium carbonate in excess then filtering; a crystallisation method (not just evaporation to dryness).

Very few students realised that magnesium carbonate should be added to excess or the mixture should be filtered. Most responses that were creditworthy included some or all of the following points: heating the reactants, evaporating the solution (often to dryness), leaving until crystals formed. A suitable container for the addition of magnesium carbonate to the acid was often not given, with the reagents being heated in a plastic bowl or petri dish.

Approximately half the students who attempted the question obtained at least two marks, usually either for a good description of the crystallisation process or for a partial description of the first and last stages.

A significant number of students started with the product itself which made it difficult to access level 2. As the question was asking for the procedure, not for observations, any colour changes given were ignored.

Higher

(a) Of the 31% of students able to recall the test for carbon dioxide, usually also knew the result of the test. A few students answered in terms of using a straw to blow through limewater.

A large number of incorrect responses referred to the hydrogen ‘pop’ test, or to extinguishing a lit splint

(b) This ‘extended response’ question was centred around a Required Practical Activity, so it was expected that students would have knowledge of the methods of preparing a soluble salt.

Key steps in the process were: using the correct reagents, mixing in a suitable container; adding the magnesium carbonate in excess then filtering; a crystallisation method (not just evaporation to dryness).

Approximately half the students who attempted the question achieved three marks, usually for descriptions of the first and last stages. Few students referred to the filtration stage or realised that magnesium carbonate should be added to excess. Those who did usually described this in terms of excess magnesium carbonate being visible rather than the absence of effervescence when magnesium carbonate was added.

Many students evaporated to dryness rather than describing a method to determine the crystallisation point. Often having evaporated all the water, students then left the substances to cool and crystallise.

As this was an ‘extended response question’ a student who used reactants which would not lead to the production of magnesium chloride was unlikely to access level 3, as the plan would not lead to a valid outcome.

A significant number of students started with the product itself which made it difficult to access level 2. As the question was asking for the procedure, not for observations, any colour changes given were ignored.

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Q18.

(a) Around half of the students correctly said that copper oxide is black. The most common distractor was “green”.

(b) Only a few students knew that limewater was used to test for carbon dioxide. Limestone was quite a common response, with others giving substances that are used in other chemical tests, such as bromine.

Q19.

(a) Less than half of the students gained one mark or more on this question. The main problem was that they did not link their explanation to an observation. Naming copper oxide as being a product was a common correct response, although some thought that copper was formed. Carbon dioxide was often given as the other product, but this only scored if it was linked to the loss in mass or the change in the colour of the limewater. A surprisingly large number of students linked the colour change of limewater to an incorrect gas, such as oxygen or hydrogen. Hardly any students scored 3 marks, failing for the most part to link the loss of mass with the production of carbon dioxide.

(b) (i) Only a tenth of students said that the temperature needed to be higher or that more energy was needed to decompose potassium carbonate. Many students referred to the compound or potassium being high in the reactivity series, which was ignored. Others said it had a high melting or boiling point.

(ii) Some students realised that the mass of potassium carbonate after heating would be 13.8 g. The response “9.4 g” was seen quite a lot. Other students said that the limewater would turn cloudy for zinc carbonate, but some struggled to describe the limewater for potassium carbonate. If they just said “clear” this did not gain the mark; they had to say “stayed clear”. “Nothing” or “none” were insufficient responses for the result with limewater. Quite a lot of students appeared to guess the results for limewater, writing the same answer in both boxes. There were quite few references to fizzing or bubbling.

Q20.

(b) Some students were not familiar with the demonstration shown in the question, so could not identify the products of the reaction.

(d) Although most students picked up 1 mark, they usually did not realise that the crude oil had to vaporise before the vapours could enter the fractionating column.

Q21.

(a) A well answered question. Some students gave a list of elements, thus negating the mark for stating hydrogen and carbon. Some gave hydro, or hydroxide instead of hydrogen and others gave carbonate instead of carbon.

(b) Most students said the limewater would turn cloudy showing carbon dioxide was produced. Some only described the limewater bubbling rather than the colour change, and some said the colour change was due to carbon. If they had checked their answer they would probably have spotted this mistake. Fewer mentioned that water was formed, and very few gained the first marking point describing condensation or a colourless liquid in the U-tube. Some misunderstood the question and described precautions to be taken when setting the apparatus up.

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Q22.

(a) This was a standard demand question, which was also on the higher paper. There were many confused responses with poor terminology. 1 mark was for stating that acids react with calcium carbonate or shells. Only a few students used the word react. The second mark was for saying the shells would be eroded, but words such as cracked, rotted, destroyed, broken or weakened were insufficient.

(b) (i) The word equation was well attempted, but as it was only worth 1 mark, both chemicals had to be named correctly. Incorrect names given included calcium cobalt and calcium dioxide. Some students listed the names of the elements in the two compounds, calcium carbon oxygen and calcium oxygen, instead of naming the substances. Students should be made aware of the names of ions given on the Data Sheet, which might have been helpful to some.

(ii) Less than half of the students understood the concept of conservation of mass, and so did not attempt to subtract one number from the other. Many added the two numbers together.

(iii) Less than a third of the students realised that the liquid that turned cloudy with carbon dioxide was limewater.

Q23.

(a) Some students answered the question in terms of advantages and disadvantages of quarries, rather than economic and environmental reasons. They did not realise that the company would want to present advantages for both reasons and gave a variety of arguments against the opening of a new quarry. Many students gained a mark for the economic reason of providing more jobs. A lot of students incorrectly thought that the quarry would be a tourist attraction.

(b) Both products were required to gain one mark. Students often named either carbon dioxide or calcium oxide only, or one of the products was named incorrectly. Common incorrect products were limewater or slaked lime. Incorrect processes named were combustion, melting, cracking and distillation. Students would benefit from learning definitions and examples of all these processes.

(c) (i) A third of students answered this question correctly. A symbol equation was asked for, but many students wrote a word equation so gained no marks. The most common errors were incorrect formulae. Calcium oxide was represented incorrectly as CaO_2 or Ca. Calcium hydroxide was usually written correctly, as it was given in the question. A surprising number did not know the formula of water. Students could not gain the marks if formulae were written with lower case letters or superscripts.

(ii) Compared to the January 2012 exams more students knew the test for carbon dioxide. However, a variety of other gases and chemicals were named. Similarly, a variety of colour changes were given. Students mixed up tests for hydrogen, oxygen and carbon dioxide. The tests for carbon dioxide and for unsaturation are the only two that students need to learn for Unit 2 C1. Almost a fifth of students did not make any attempt at answering this question.

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