Rewarding Learning

General Certificate of Secondary Education
2013

Double Award Science: Chemistry

Unit C2

Higher Tier

[GSD52]

MONDAY 10 JUNE 2013, AFTERNOON

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

	AVAILABLE MARKS

1 **(i)** Black [1] to pink/reddish orange/red-brown/orange-brown [1] [2]

(ii) Copper [1] Water [1] either order [2] 4

2 **Indicative Content**

Advantages

- Use of limestone building industry/liming of soil
- Provides jobs (for locals)
- Good for local economy
- Disused quarry can be used for landfill
- Helps road infrastructure for transporting limestone

or other correct

Allow maximum of 4 indicative points for advantages

Disadvantages

- Noisy machinery
- Unsightly
- Destruction of habitats
- Fumes, pollution from machinery and heavy lorries
- Idea of traffic congestion

or other correct, e.g. danger if qualified

Allow maximum of 4 indicative points for disadvantages

When annotating apply indicative point ticks for advantages on LHS of answer at appropriate line(s) of answer; apply indicative point ticks for disadvantages on RHS of answer at appropriate line(s) of answer;

Response	**Mark**
Candidates make correct reference to 6–8 of the indicative points shown. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates make correct reference to 4–5 of the indicative points shown. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates make correct reference to 1–3 of the indicative points shown. The form and style are of a limited standard.	[1]–[2]
Candidates make no correct reference to any of the indicative points	[0]

[6] 6

					AVAILABLE MARKS
3	**(a)**	**(i)**	Hydrogen	[1]	
		(ii)	Idea of producing the steam	[1]	
		(iii)	White (allow yellow)	[1]	
		(iv)	Magnesium/aluminium/iron	[1]	
	(b)	**(i)**	Any **two** of (burns with) a bright/white light/flame [1] to form a white powder/ash/solid allow white smoke heat given out/exothermic reaction [1] idea of very vigorous reaction [1] (max 2 × [1])	[2]	
		(ii)	$2Mg + O_2 \rightarrow 2MgO$ [1] for MgO and [1] for balancing if formula is correct	[2]	8
4	**(a)**		Nitrogen [1] 79% ± 1% [1] Oxygen [1] 20% ± 1% [1]	[4]	
	(b)	**(i)**	Idea that between 1750 and 1900 there was a gradual increase [1] Idea that 1900–2000 greater increase in CO_2 production [1] Idea of increase over time gains [1] NB Answer which links CO_2 with temperature gains no credit	[2]	
		(ii)	Idea that as carbon dioxide level increases global temperature increases **not** idea that as temperature rises so do CO_2 levels	[1]	
		(iii)	Burning of (more) fossil fuels/deforestation **or** other correct, e.g. idea of more vehicles **not** population increase	[1]	
		(iv)	Idea of melting of polar ice caps/sea levels rising/flooding in low lying areas/droughts in some areas/ecosystems will change **or** other correct	[1]	
	(c)	**(i)**	Soluble in water/accept idea of non-toxic/no smell/colourless/ tasteless	[1]	
		(ii)	Carbonic acid	[1]	
		(iii)	Limewater is colourless [1] **not** clear Turns milky or cloudy [1] **not** just turns white	[2]	
		(iv)	Then turns colourless/idea that cloudiness disappears/precipitate dissolves	[1]	14

AVAILABLE MARKS

5 (a) Indicative content

- Water containing calcium and/or magnesium ions
  or Does not form a lather easily with soap

Description of test

- Same volume of two water samples unless wrongly qualified
- Addition of soap (solution)
- Idea of 1 cm^3 at a time/idea of one fixed volume of soap
- Shaken/stirred
- Addition repeated until a (permanent) lather is formed
  or Idea of measuring height/amount of lather
- Correct statement of results: The sample needing most soap to lather is hard **or** converse **or** sample with least lather is hard **or** converse

Response	Mark
Candidates must use specialist terms throughout to fully explain definition of hard water and describe a fair test which you could carry out to find which is a hard water sample in a logical sequence (6 or 7 indicative points required). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates use some specialist terms to explain the definition of hard water and describe a fair test which you could carry out to find which is the hard water sample in a logical sequence (4 or 5 indicative points required). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates explain the definition of hard water or describe a fair test which could be carried out to find which is a hard water sample (1–3 indicative points required). They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
Response not worthy of credit	[0]

[6]

(b) (i) Calcium/magnesium ion or Ca^{2+}/Mg^{2+} [1]

(ii) Good for teeth and bones/tastes better/reduces heart disease [1]

(iii) Brewing or other correct, e.g. bottled water, water softening, soap making Allow plumbing [1]

(iv) An advantage of soft water [1] related to less cost [1]
e.g. less soap is needed to form lather [1]
idea that householder spends less money on soap [1]
or
e.g. In hard water town limescale builds up on pipes [1]
pipes may have to be replaced [1]
or
fur in kettles [1]
more electricity used to heat water [1]
or other correct, e.g. having to replace/use more energy with an electrical device which uses hot water gets the expense mark.
Problem caused by the water needed for second mark. [2]

					AVAILABLE MARKS
	(c)	**(i)**	Calcium hydrogencarbonate	[1]	
		(ii)	Temporary hard water contains calcium ions and hydrogencarbonate ions (in solution) [1] when heated the hydrogencarbonate ions (thermally decompose to) form carbonate ions [1] The carbonate ions react with calcium ions in the water to form calcium carbonate [1] which precipitates out removing calcium ions/removing hardness [1]	[4]	16
6	**(a)**		Idea that products form reactants **and** reactants form products For partially correct reaction idea, not using the term reversed [1]	[2]	
	(b)		$N_2 + 3H_2 \rightleftharpoons 2NH_3$ LHS [1], reversible sign [1], RHS [1], balancing if LHS and RHS correct [1]	[4]	
	(c)		Iron	[1]	7
7	**(a)**		Explicit idea of more particles (in same volume) [1] Idea of more collisions (faster reaction) [1] Reference to more energy negates collision mark	[2]	
	(b)		Idea that particles have more energy [1] move faster/more particles possess activation energy [1] Idea of more collisions [1] Max [2] points out of [3] Idea of harder/more energetic collisions/more successful collisions [1]	[3]	5
8	**(a)**		Mass of an atom [1] compared with that of a carbon-12 isotope [1] which has mass of exactly (clearly implied) 12 [1]	[3]	
	(b)	**(i)**	233	[1]	
		(ii)	261	[1]	
		(iii)	13.05/261 = 0.05 Allow CM	[1]	
		(iv)	11.65 Allow CM	[1]	
	(c)	**(i)**	Two moles of solute/sodium hydroxide/allow solid/substance in 1l/dm^3/1000 cm^3 **of solution** [1] **not** 'of water'	[2]	
		(ii)	100 cm^3	[1]	10

					AVAILABLE MARKS
9	(a)	(i)	Idea that fossil fuels have been formed from living organism	[1]	
		(ii)	Carbon	[1]	
		(iii)	Clear idea that the resource is finite **not** idea that it can only be used once	[1]	
	(b)	(i)	It burns to give out energy/burning ethanol produces less carbon dioxide than natural gas/other fuels/it can be obtained from crops/it can be used in cars/**or** other correct, e.g. idea that it is renewable **or** that it saves fossil fuels	[1]	
		(ii)	Idea of cost of production/idea that using food crops could mean that people could go hungry/**or** other correct	[1]	
		(iii)	Idea that burning hydrogen does not produce any carbon dioxide/ greenhouse gases **or** product is water only – clearly implied	[1]	
	(c)	(i)	$C_nH_{2n+1}OH$	[1]	
		(ii)	OH (group) or O–H (group)	[1]	
		(iii)	C_2H_5OH or CH_3CH_2OH	[1]	
	(d)		$C_2H_4 + H_2O \rightarrow C_2H_5OH$ LHS [1] RHS [1] Apply CM for C_2H_6O	[2]	
	(e)	(i)	$2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$ (**or** double this) LHS [1] RHS [1] [1] for balancing if all formulae correct	[3]	
		(ii)	Carbon monoxide	[1]	
	(f)		Test: idea of using bromine water/solution [1] idea of shaking the mixture [1] **not** bubbling Result with hexene – goes from brown/orange/yellow or combination or red-brown [1] to colourless [1] Award [1] for bromine water decolourised Result with hexane – idea of colour not disappearing [1] or no reaction **not** nothing	[5]	20
				Total	**90**