Rewarding Learning

General Certificate of Secondary Education
2014

Double Award Science: Chemistry

Unit C2

Higher Tier

[GSD52]

TUESDAY 10 JUNE 2014, 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 (a) Planning a method to study or measure the rate of the reaction between dilute hydrochloric acid and marble chips.

Feasible methods enable either the (loss in) mass to be measured/recorded or the volume of gas produced to be measured/recorded.

Indicative Points:

- Placing the dilute acid and the marble chips in a suitable reaction container
- Using a (top pan) balance **or** using a gas syringe – in a correct context
- Clear idea of timing the reaction – in the context of a sensible suggestion
- At the start weigh the contents of the beaker/flask **or** at the start take an initial syringe reading/zero the syringe
- Look for Loss in mass **or** Gain in (gas) volume **or** marble chip to disappear/reaction to stop.
- Measure/record the change in mass **or** the gain in volume.
- Either idea of measuring/recording the change at different times **or** (in a case where one result is being taken) at an appropriate time, e.g. when "it" stops fizzing/when "it" has been reacting for x seconds.
- Idea of plotting a graph (using the results) **or** idea of calculating the rate.
- Idea that the graph should be mass **or** volume against time **or** that the rate calculation is mass or volume/time.

Response	Mark
Candidates must use specialist terms throughout to plan the experiment in a logical sequence (6 or more 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 plan the experiment in a logical sequence (4 to 5 indicative points required). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates give 1 to 3 of the indicative points tested but not necessarily in a logical sequence. 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) Increased concentration means more particles/more collisions [1]
(thus) more high energy/more successful collisions [1]
and faster reaction [1] [3]

(c) (i) Volume of H_2 gas (cm^3) Unit needed [1]

(ii) 8–9 correct points (within $\frac{1}{2}$ square) [2]
7 correct points [1]
Smooth curve [1] [3]

(iii) 90(s) **or** 90 seconds Units needed [1]

(iv) 30 ± (s) 30 ±1 (s) seconds [1]

Apply c.m. if units absent in **(iii)** and **(iv)**
If answer outside 29–31 second range check graph again – if answer/error due to poor curve penalise curve in **1(c)(ii)** but allow answer in **1(c)(iv)**.

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					AVAILABLE MARKS
2	**(a)**	**(i)**	85	[1]	
		(ii)	98	[1]	
		(iii)	74	[1]	
	(b)		The relative formula mass [1] in grams [1] of a substance second mark depends on first **or** 6×10^{23} [1] atoms/molecules/ions/particles [1] second mark depends on first **or** The amount of a substance that contains the same number of atoms/ molecules/ions/particles as [1] there are in 12 g of carbon-12 [1]	[2]	
	(c)	**(i)**	0.5 mole	[1]	
		(ii)	1 mole **or** c.m. answer i.e. **(c)(i)** × 2	[1]	
		(iii)	56 g Apply c.m.	[1]	
		(iv)	5.6 (tonnes) Apply c.m. i.e. **(c)(iv)** answer numerically is 0.1 × **(c)(iii)** answer	[1]	
	(d)	**(i)**	It becomes 0.20 mol/dm^3	[1]	
		(ii)	It stays the same	[1]	11
3	**(a)**	**(i)**	Calcium oxide [1] Carbon dioxide [1] either order	[2]	
		(ii)	Takes in heat energy from the surroundings	[1]	
		(iii)	Thermal decomposition	[1]	
	(b)		Bonds are broken in named reactants (methane and oxygen) [1] Ideas that energy is needed to break bonds/bond breaking is endothermic [1] Bonds are made in named products (carbon dioxide and water) [1] Idea that energy is given out when bonds are made/bond making is exothermic [1] **Clear** idea that the reaction is exothermic because **more** energy is released in bond making than is needed for bond breaking – No credit for simply stating that reaction is exothermic because heat/energy is given out [1] **max** (5 × [1])	[5]	
			The first and third marking points require named reactants and products to be given – if answer is a generic one then maximum mark is [3]; if 2 of the 4 chemicals are appropriately referred to, i.e either both reactants or both products or 1 of each, then maximum mark is [4]; for all 5 marks at least 3 of the 4 chemicals must be explicitly referred to; if 0 or 1 reactants/products given maximum is [3] for a generic answer.		9

				AVAILABLE MARKS
4	**(a)**	**(i)**	Calcium or magnesium hydrogencarbonate [1]	
		(ii)	Carbon dioxide dissolves in rainwater [1] to form (carbonic) acid/an acid solution. [1] This **reacts** with (insoluble) calcium carbonate/limestone [1] to form **a soluble** calcium compound/soluble calcium hydrogencarbonate/ calcium ions in solution [1] [4]	
	(b)		Carbonate ions (from the washing soda) [1] combine with calcium ions [1] from the hard water to form insoluble calcium carbonate/limestone [1] removing calcium ions from solution [1] Any 3 from 4 [3] **or** $Ca^{2+}(aq) + CO_3^{2-}(aq) \rightarrow CaCO_3(s)$ [1] [1] [1]	8
5	**(a)**	**(i)**	73–75% [1]	
		(ii)	Idea of being "locked/trapped" in fossil fuels Idea of being "locked/trapped" in carbonates/limestone Idea of being absorbed/used by plants/trees in photosynthesis Idea of being dissolved in oceans Any 2 × [1] [2]	
	(b)	**(i)**	$SrSO_4$ [1]	
		(ii)	Idea that it would not dissolve/no reaction/go milky [1] **Not** "nothing"	
		(iii)	Any of the following ideas: It reacts (fairly) vigorously/speeds up (**Not** violent **Not** slow) It sinks **or** sinks and floats (**Not** floats alone) Fizzing/effervescence/bubbles Solution formed/strontium dissolves/disappears Idea that solution is **colourless** Accept idea that water goes cloudy An exothermic reaction happens Or other correct, i.e. linked to reaction of calcium but a bit quicker **Not** linked to sodium reaction. **max** (3 × [1]) [3]	8

						AVAILABLE MARKS
6	**(a)**	**(i)**	colourless [1] odourless [1] (if 3 ticks – 2 correct award [1]		[2]	
		(ii)	Food packaging/coolant or other correct		[1]	
	(b)	**(i)**	Reversible reaction		[1]	
		(ii)	Temperature: 250–450 °C [1] Catalyst: Iron [1] Pressure: 200–500 atm [1]		[3]	
		(iii)	Manufacture of fertilisers Production of nitric acid Manufacture of nylon Or other correct **max** (2 × [1])		[2]	9
7	**(a)**	**(i)**	Haematite **not** iron oxide		[1]	
		(ii)	Limestone/calcium carbonate [1]/coke/carbon [1] ANY order		[2]	
		(iii)	(Blast) of hot air		[1]	
		(iv)	Idea that (molten) iron is tapped off/run off		[1]	
		(v)	Name: idea of reacting with calcium oxide [1] slag produced/ calcium silicate **or** product is tapped off [1]		[2]	
	(b)		$CO_2 + C \rightarrow 2CO$ [1] for reactants [1] for products and [1] for balancing		[3]	
	(c)	**(i)**	Oxidation and reduction occur [1] in the same reaction/ simultaneously		[2]	
		(ii)	Electron gain [1] by the iron **ion** [1]		[2]	14

AVAILABLE MARKS

8 **(a)** Definition of homologous series
Family of organic molecules with:
- Same general formula $C_nH_{(2n+1)}OH$
- Similar chemical properties/similar reactions
- differ by CH_2
- gradation in physical properties

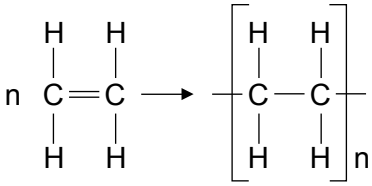
Similarities between methanol and ethanol
- Both liquids/low BP **not** "not hydrocarbons"
- Both colourless
- Both water soluble
- Both contain an –OH group
- Burn to give CO_2 and H_2O/burn/flammable
- Idea that both can be fuels
- Idea that both are solvents

Response	Mark
Candidates must use specialist terms throughout. Definition of homologous series must be included (at least 7 indicative points required including at least 2 definition points). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates use some specialist terms throughout. Definition of homologous series must be included (4–6 indicative points including at least 1 definition point). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates include 1–3 of the indicative points. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
Response not worthy of credit. Candidates do not make reference to any of the indicative points above and offer no other suitable response.	[0]

[6]

(b) **(i)** In alcoholic drinks [1]
As a solvent [1]
or other correct
max (2 × [1]) [2]

(ii) $C_2H_4 + H_2O \rightarrow C_2H_5OH$
[1] for reactants and [1] for products [2]

			AVAILABLE MARKS
(c)	**(i)** 		
	[1] for correct monomer structure [1] for correct polymer structure in brackets [1] for n before **ethene** [1] for indicating repeat (repeat can be brackets* and n after or a mininum of 3 repeating units) *bonds must extend beyond brackets No arrow, maximum [3]	[4]	
	(ii) Chemically inert/unreactive/lightweight/flexible or can be easily moulded into shape/can be coloured/durable/waterproof [1] for each property correctly related to named use to a maximum of [2] **not** hard, **not** strong, **not** cheap	[2]	16
		Total	**90**