CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2013 series

9701 CHEMISTRY

9701/23

Paper 2 (AS Structured Questions), maximum raw mark 60

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.



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	GCE AS/A LEVEL – May/June 2013	9701	23

1 (a) (i)

S atom has 6 **and C** atom has 4 electrons (1)

S=C double bonds (4 electrons) clearly shown (1)

(ii) linear and 180° (1) [3]

(b) (i) $CS_2 + 3O_2 \rightarrow CO_2 + 2SO_2$ (1)

(ii) enthalpy change when 1 mol of a substance (1)

is burnt in an excess of oxygen/air

or is completely combusted

under standard conditions (1) [3]

(c)

$$CS_2 + 3O_2 \rightarrow CO_2 + 2SO_2$$

 $\Delta H_f \ominus / kJ \, \text{mol}^{-1} \, x - 395 \qquad 2(-298)$ (1)
 $\Delta H_{\text{reaction}} = -395 + 2(-298) - x = -1110 \, kJ \, \text{mol}^{-1}$ (1)
gives $x = -395 + (-596) + 1110 = +119 \, kJ \, \text{mol}^{-1}$ (1) [3]

(d) (i) $CS_2 + 2NO \rightarrow CO_2 + 2S + N_2$ or $CS_2 + 2NO \rightarrow CO + 2S + N_2O$

correct products (1)

correct equation (1)

(ii) from -2 to 0 both required (1) [3]

[Total: 12]

Mark Scheme

Page 3

Syllabus

Paper

					GCE AS/A	A LEV	EL – May/	June 2	2013		9701	23	
2	(a)	(i)	if the	e conditi	ons of a sys	stem i	n equilibriu	m are	changed			(1)	
			the p	oosition	of equilibriu	ım mo	oves so as f	to redu	ce that cha	ange		(1)	[2]
		(ii)	lowe	er tempe	erature							(1)	
			beca	ause the	forward re	action	is exother	mic				(1)	
			high	er press	sure							(1)	
				ause the	forward re	action	shows a re	eductio	n in volum	е			
			or there	e are fe	wer molecul	les/m	oles on RH	S of ed	quilibrium			(1)	[4]
	(b)				CO ₂	+	H_2	=	СО	+	H ₂ O		
		initi	ial mo	les	0.70		0.70		0.30		0.30		
		equ	uil. mo	oles	(0.70-x)		(0.70-x)		(0.30+x)		(0.30+x)	(1)	
		equ	uil. co	ncn.	(0.70–x) 1		(0.70-x) 1		(0.30+x) 1		(0.30+x) 1		
		K _c :	= <u>(0.3</u> (0.7	$\frac{(0+x)^2}{(0-x)^2} =$	1.44							(1)	
		at e	equilib	: 0.25 orium,	. 0. 70 . 0. 20	5 – 0	15 malaa					(1)	
		and		· //(П2) -	0.70 – 0.2	J – U.							

 $n(CO) = n(H_2O) = 0.3 + 0.25 = 0.55 \text{ moles}$

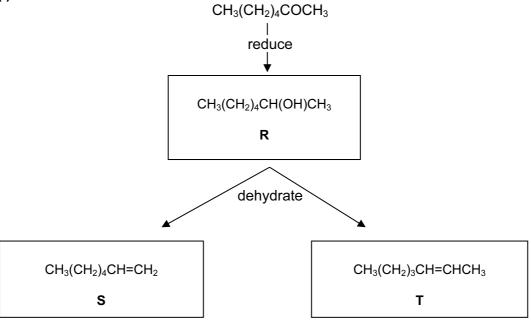
[Total: 10]

(1) [4]

	Page 4		Mark Scheme	Syllabus	Paper	·
			GCE AS/A LEVEL – May/June 2013	9701	23	
3	(a) (i)	He c	or Ne or Ar or Kr		(1)	
	(ii)	P or	⁻ As		(1)	
	(iii)	Br			(1)	
	(iv)	Na	allow Ar		(1)	
	(v)	Si			(1)	
	(vi)	P all	ow Si		(1)	
	(vii)	Cl o	r F or Br		(1)	[7]
	(b) (i)	any	two from P_4O_6 , SO_2 and Cl_2O_7		(1+1)	
	(ii)	Al₂C	O ₃ or SiO ₂		(1)	
	(iii)	MgS	SO_3		(1)	[4]
	(c) (i)	Si is	giant molecular/giant covalent or			
		P, S	, and C $\it l$ are simple molecular		(1)	
	(ii)	the r	molecules are S ₈ , P ₄ , C <i>l</i> ₂		(1)	
		large	er molecules have more electrons		(1)	
		and	hence greater van der Waals' forces		(1)	[4]
					[Total:	: 15]

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4 (a) (i)



one mark for each correct compound, R, S and T

allow correct cis and trans versions of compound T for 2 marks (3×1)

(ii) reduction

NaBH₄ or LiA
1
H₄ or H₂/Ni or Na/C₂H₅OH (1) dehydration

$$P_4O_{10}/P_2O_5$$
 or H_3PO_4 or conc. H_2SO_4 or Al_2O_3 (1) [5]

(b)

Tollens' reagent	NO REACTION	
HCN	CH ₃ (CH ₂) ₄ C(OH)CH ₃ CN	
K ₂ Cr ₂ O ₇ /H ⁺	NO REACTION	

one mark for each correct answer (3×1) [3]

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(c) Na₂CO₃ or NaHCO₃ effervescence/colourless gas

or

Na colourless gas

or

 PCl_3/PCl_5 etc. steamy fumes

or

 $C_2H_5OH/conc.\ H_2SO_4$ sweet smell of ester

or

 $K_2Cr_2O_7/H^{\scriptscriptstyle +}$ orange solution becomes green

correct reagent (1)

correct observation (1) [2]

[Total: 10]

Syllabus

Paper

[Total: 13]

Mark Scheme

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		GCE AS/A LEVEL – May/June 2013	9701	23	
5	(a) (i)	CH ₂ =CHCO ₂ H		(1)	
	(ii)	BrCH ₂ CHBrCH ₂ OH		(1)	
	(iii)	product is HOCH ₂ CH(OH)CH ₂ OH			
		correct addition across >C=C<		(1)	
		original –CH₂OH remains		(1)	
	(iv)	HO ₂ CCO ₂ H		(1)	[5]
	(b) (i)	nucleophilic substitution		(1)	
	(ii)	oxidation		(1)	[2]
	(c) (i)	step I			
		H_2		(1)	
		heat with Ni catalyst		(1)	
		step II			
		acidified K ₂ Cr ₂ O ₇		(1)	
		heat or distil off product		(1)	
	(ii)	structural isomerism or			
		functional group isomerism		(1)	[5]
	(d) both oxidation and reduction have occurred or				
	dis	proportionation has taken place		(1)	[1]