

Cambridge International Examinations

Cambridge International Advanced Subsidiary and Advanced Level

CHEMISTRY 9701/23

Paper 2 AS Level Structured Questions

May/June 2016

MARK SCHEME
Maximum Mark: 60

Published

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Page 2	Mark Scheme	Syllabus	Paper
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Question	Mark Scheme	Mark	Total
1 (a) (i)	$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$	[1]	[1]
(ii)	$Cr_2O_7^{2-} + 14H^+ + 6Fe^{2+} \rightarrow 2Cr^{3+} + 6Fe^{3+} + 7H_2O$	[1]	[1]
(iii)	$(0.025 \times 32.0/1000=) 8 \times 10^{-4}$	[1]	[1]
(iv)	$(8 \times 10^{-4} \times 6 =) 4.8 \times 10^{-3}$	[1]	[1]
(v)	$(4.8 \times 10^{-3} \times 250/25.0=) \ 4.8 \times 10^{-2}$	[1]	[1]
(vi)	$(4.8 \times 10^{-2} \times 55.8 =) 2.68/2.678$	[1]	[1]
(vii)	(2.68/3.35=) 80%	[1]	[1]
(b) (i)	covalent small(er) difference in electronegativity between Fe and C l (than between A l and C l)	[1] [1]	[2]
(ii)	FeC l_3 + 6H ₂ O → [Fe(H ₂ O) ₆] ³⁺ 3C l^- OR FeC l_3 + 6H ₂ O → [Fe(H ₂ O) ₆ OH] ²⁺ + H ⁺ + 3C l^-	[1]	[1]
			[10]
2 (a)	$NH_3 + HNO_3 \rightarrow NH_4NO_3$	[1]	[1]
(b) (i)	line from origin AND below left-hand end of original with peak to right of and lower than original crosses original once AND above right-hand end of original AND above energy axis	[1] [1]	[2]
(ii)	(curves show) more molecules with $E > E_a$ (at higher T) so greater frequency of successful (owtte) collisions/more successful (owtte) collisions per unit time	[1] [1]	[2]
(iii)	catalysed E_a shown to left of original on horizontal axis so more molecules with $E > E_a$ (in presence of catalyst)	[1] [1]	[2]

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(iv)	production of ammonia is <u>exothermic</u> /(forward) reaction <u>exothermic</u> position of eqm would move to left/reverse/reduce yield (at higher T)	[1] [1]	[2]
(c)	$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$ N changes from -3 to $+2$ (so oxidation) O changes from 0 to -2 (so reduction)	[1] [1] [1]	[3]
(d) (i)	H (+) + N : H + N : H H	[1+1]	[2]
(ii)	shape = tetrahedral angle = 109°–109.5°	[1] [1]	[2]
(e)	eutrophication/algal bloom/stimulates growth of algae (bacteria) use up oxygen when decomposing the plants/algae block light for plants so less oxygen produced aquatic life/fish die (due to lack of oxygen)	[1] [1] [1] [1]	[max 3]
			[19]
3 (a) (i)	vaporise/boil/turn to gas	[1]	[1]
(ii)	increasing molecular size/no of carbon atoms per molecule/length of carbon chain	[1]	[1]
(iii)	increasing b.pt/decreasing volatility increasing viscosity increasing density increasing depth of colour decreasing flammability/decreasing 'cleanliness' of flame owtte	[1] [1]	[2]
(b) (i)	$C_{12}H_{26} \rightarrow 2C_2H_4 + C_8H_{18}$	[1]	[1]

Page 4	Mark Scheme	Syllabus	Paper
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(ii	ethene use = making polythene/plastic/polymers feature of ethene = double bond/unsaturated octane/alkane use = fuel/petrol feature of octane/alkane = flammability/releases energy when burned/combusted	[1] [1] [1] [1]	[4]
(c) (i	(produced by) reaction of (atmospheric) oxygen and nitrogen due to high temperature/engine provides energy/combustion provides energy	[1] [1]	[2]
(iii	2NO + 2CO \rightarrow N ₂ + 2CO ₂ / NO + CO \rightarrow $\frac{1}{2}$ N ₂ + CO ₂	[1]	[1]
(iii	$NO + \frac{1}{2}O_2 \rightarrow NO_2$ $NO_2 + SO_2 \rightarrow SO_3 + NO$ $SO_3 + H_2O \rightarrow H_2SO_4 / 2H^+ + SO_4^{2-} / H^+ + HSO_4^-$	[1] [1] [1]	[3]
(iv	lowers pH of rivers/lakes/kills fish leaches (toxic) aluminium from soil (into rivers/lakes) leaches away soil nutrients damage to buildings/statues/trees/plants/crops ocean acidification/damage to coral	[1] [1] [1] [1]	[max 2]
			[17]
4 (a)	3-hydroxybutan(-2-)one	[1]	[1]
(b)	$H_2/Cr_2O_7^{2-}$ or names	[1]	[2]
	heat/reflux/warm	[1]	
(c) (i	absorption at 1670–1740 C (=) O absorption at 2850–3000 C (-) H absorption at 3200–3650 O (-) H	[1] [1] [1]	[3]

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(ii)	no absorption at 3200–3650 O-H disappears / no O-H bond in diacetyl	[1] [1]	[2]
(d) (i)	CH ₃ COCH(=)CH ₂	[1]	[1]
(ii)	one of the double-bonded C atoms/first C has 2H atoms attached ora so no cis-trans/ <i>E-Z</i> /geometric(al) isomerism possible OR no chiral C so mirror images superimposable/molecule not asymmetric	[1] [1]	[2]
(iii)	asymmetric/chiral C atom/carbon with four different groups/atoms attached	[1]	[1]
(iv)	COCH ₃ H ₃ COC Br CH ₃ H ₃ C Br	[1+1]	[2]
			[14]