edexcel
advancing learning, changing lives

Mark Scheme (Results)
January 2011

GCE O

O Level Chemistry (7081) Paper 02

Edexcel Limited. Registered in England and Wales No. 4496750
Registered Office: One90 High Holborn, London WC1V 7BH

A PEARSON COMPANY

Edexcel is one of the leading examining and awarding bodies in the UK and throughout the world. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers.

Through a network of UK and overseas offices, Edexcel's centres receive the support they need to help them deliver their education and training programmes to learners.

For further information, please call our GCE line on 0844 576 0025, our GCSE team on 0844 576 0027, or visit our website at www.edexcel.com.

If you have any subject specific questions about the content of this Mark Scheme that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

Ask The Expert can be accessed online at the following link:

http://www.edexcel.com/Aboutus/contact-us/

Alternately, you can speak directly to a subject specialist at Edexcel on our dedicated Science telephone line: 0844 576 0037

(If you are calling from outside the UK please dial + 44 1204 770 696 and state that you would like to speak to the Science subject specialist).

January 2011

7081/02 O-LEVEL CHEMISTRY MARK SCHEME – JANUARY 2011

SECTION A

Question 1			
(a)	M1	any specified ammonium salt + sodium, potassium or calcium hydroxide *(acceot CaO)* *(accept name or formula* NH_4Cl $(NH_4)_2SO_4$ $NaOH$ $Ca(OH)_2$*)*	(1)
	M2	CaO / calcium oxide / quicklime / soda lime / silica gel	(1)
	M3	upward delivery / downward displacement of air / syringe	(1)
	M4	equation $NH_4Cl + NaOH \rightarrow NaCl + NH_3 + H_2O$ $2NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + 2NH_3 + 2H_2O$ $(NH_4)_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2NH_3 + 2H_2O$ $NH_4^+ + OH^- \rightarrow NH_3 + H_2O$	(1) **(4)**
(b)	(i)	$2NH_3 + 3CuO \rightarrow N_2 + 3Cu + 3H_2O$	(1)
	(ii)	black to red-brown / brown / pink / red *(must be colour change)*	(1)
	(iii)	ammonia because it has lost hydrogen / oxidation number of nitrogen increased (from –3 to 0) / gained oxygen to give N_2 and H_2O	(1) **(3)**
(c)	M1	M_r $(NH_4)_2SO_4$ = 132	(1)
	M2	28/132 x 100% *(28 / M1) x 100*	(1)
	M3	= 21.2% *(answer to M2 provided 28 has been used in M2)*	(1) **(3)**

Total 10 marks

Question 2			
(a)	(i)	$Ag^+ + e^- \rightarrow Ag$	(1) **(1)**
	(ii)	*(There must be an attempt at a Ag equation to score in part (ii)*	(1)
		M1 1 F gives 108 g silver *(consequential on moles of electrons in equation)*	
		M2 0.10 f gives 10.8 g silver	(1)
		(if equation contains $2e^-$, M1 2F gives 108g M2 answer 5.4g)	**(2)**
	(iii)	M1 <u>oxygen</u> *(must be <u>name</u>)*	(1)
		M2 relights glowing spill *(dependent on oxygen / O_2 for M1)*	(1) **(2)**
	(iv)	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$ (or 4e)	(1) **(1)**
(b)	M1	impure silver (block) as the anode	(1)
	M2	pure silver as the cathode	(1)
	M3	use of silver nitrate or silver sulphate as electrolyte.	(1)
	M4	$Ag \rightarrow Ag^+ + e^-$ *(dependent on correct electrodes)*	(1)
		If impure Ag cathode and pure Ag anode used, lose M1 and M2	
		M3 use of silver nitrate or silver sulphate as electrolyte	
		M4 $Ag^+ + e^- \rightarrow Ag$	**(4)**

Total 10 marks

Question 3		
(a)	any **three** of floats / moves around the surface melts (H_2) (burns with a) lilac flame / catches fire effervesces / fizzes / bubbles (of gas formed)	 (1) (1) (1) **(3)**
(b) (i)	M1 moles of potassium = 0.195/39 = 0.005 M2 moles KOH = 0.005 *(answer to M1)* M3 conc = 0.005 x $\frac{1000}{200}$ = 0.025 (mol dm^{-3}) *(answer M2 x 5)*	(1) (1) (1) **(3)**
(ii)	higher because a greater number of moles of Na/NaOH	(1) **(1)**
(c)	green precipitate brown precipitate blue precipitate	(1) (1) (1) **(3)**

Total 10 marks

Question 4			
(a)	(i)	<u>methane</u> low<u>est</u> boiling point / short<u>est</u> chain length / small<u>est</u> molecule	(1) **(1)**
	(ii)	vaporisation / boiling / liquid to gas condensation / liquefaction / gas to liquid	(1) (1) **(2)**
	(iii)	M1 176/44 = 4 moles M2 heat evolved = 4 x 2220 = (–) 8880 kJ *(M1 x 2220)*	(1) (1) **(2)**
(b)	M1	filter paper suspended in beaker	(1)
	M2	named / formula of solvent (at bottom of beaker) *(water / ethanol / propanone etc)*	(1)
	M3	spot of material just above level of solvent *(must be 1 spot and not 3 separate spots)*	(1)
	M4	leave until solvent has risen up paper	(1)
	M5	diagram showing clear separation of 3 spots *(marks can be obtained from a diagram of the procedure)* *(Lupyjuice in beaker scores zero*	(1) **(5)**

Total 10 marks

Question 5		
(a)	have the same molecular formula but with different structural formulae/structures	(1) (1) **(2)**
(b)	$CH_3CH_2CH_2OH$ *(or displayed formulae)* $CH_3CH(OH)CH_3$ $CH_3.CH.CH_3$ | OH *(must be C – O bond)*	(1) (1) **(2)**
(c) (i)	turns lime water milky / turbid / cloudy / white / chalky / white ppte	(1) **(1)**
(ii)	acid / contains a carboxyl group / contains COOH group CH_3CH_2COOH with COOH drawn out showing bonding O ‖ *(minimum)* C_2H_5 C OH	(1) (1) **(2)**
(iii)	CH_3COOCH_3 showing bonding in the ester group O ‖ *(minimum)* CH_3 C OCH_3 $HCOOC_2H_5$ showing bonding in the ester group O ‖ *(minimum)* H C OC_2H_5 methyl ethanoate or ethyl methanoate *(must be spelt correctly)* *(name related to correct structure if two names given, both must be correct to score.)*	(1) (1) (1) **(3)**

Total 10 marks

TOTAL FOR SECTION A: 50 MARKS

SECTION B

Question 6			
(a)	(i)	<u>limestone</u> <u>coke</u> <u>air</u>	(1) (1) (1) **(3)**
	(ii)	$C + O_2 \rightarrow CO_2$ $CO_2 + C \rightarrow 2CO$ $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ **or** $Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$ *(if both reduction equations given, both must be correct)*	(1) (1) (1) **(3)**
	(iii)	M1 use of limestone M2 slag /calcium silicate formed M3 $CaCO_3 \rightarrow CaO + CO_2$ M4 $CaO + SiO_2 \rightarrow CaSiO_3$ (or $CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2$ scores M3 and M4)	(1) (1) (1) (1) **(4)**
(b)	(i)	M1 *(appearance of Fe)* turns red-brown / brown / orange-brown M2/(M3) *(water level)* water level rises M3 by 20/21% / 20/21 cm^3 / 1/5 M4/(M5) *(explanation)* iron reacts with <u>oxygen</u> (in the air) M5 iron forms iron(III) oxide / Fe_2O_3 M6 *(equation)* $4Fe + 3O_2 \rightarrow 2Fe_2O_3$	(1) (1) (1) (1) (1) (1) **(6)**
	(ii)	M1 filings have a greater surface area M2 more (frequent) collisions (between air / oxygen and Fe)	(1) (1) **(2)**

(c) (i)	M1	magnesium fuse / burning magnesium / high temperature / 1000^0C *(not heat)*	(1)
	M2	glows red/white hot / molten iron formed/ yellow flame	(1)
	M3	$2Al + Fe_2O_3 \rightarrow 2Fe + Al_2O_3$	(1) **(3)**
(ii)	$Fe_2O_3 \rightarrow 2Fe$		
	M1	use of 1 to 2 mole ratio either 160g $Fe_2O_3 \rightarrow$ 112g Fe OR moles of Fe = 224/56 = 4 and moles of Fe_2O_3 = 2	(1)
	M2	320g of Fe_2O_3 required	(1) **(2)**
(d)	M1	iron is a catalyst	(1)
	M2	speeds up the reaction	(1) **(2)**

Total 25 marks

Question 7		
(a)	M1 and M2 any 2 of similar / same chemical reactions graded physical properties same functional group successive members increase by $-CH_2$ M3 alkane is C_nH_{2n+2} M4 alkene is C_nH_{2n} *(if general formula given but not related to the homologous series, assume the 1st formula is that of the alkane)*	 (1) (1) (1) (1) **(4)**
(b)	hydrocarbon contains hydrogen and carbon <u>only</u> unsaturated contains a double / multiple bond	(1) (1) **(2)**
(c)	ethane: M1 uv light / sunlight / high temperature / 500^0C M2 substitution M3 $C_2H_6 + Br_2 \rightarrow C_2H_5Br + HBr$ $(CH_3.CH_3)$ (CH_3CH_2Br) M4 bromoethane ethene: M5 bromine water / bromine in organic solvent / room temperature / add liquid bromine M6 addition M7 $CH_2=CH_2 + Br_2 \rightarrow CH_2Br.CH_2Br$ *(do not accept C_2H_4, CH_2CH_2, $C_2H_4Br_2$)* M8 <u>1,2</u>-dibromoethane	(1) (1) (1) (1) (1) (1) (1) (1) (1) **(8)**

(d)	M1	break 8(C – H) and 1(O = O) <u>OR</u> (8 x 410) + 495 3280 + 495	(1)
	M2	Total = 3775 (kJ)	(1)
	M3	Form 4(C – H), 1(C = C), 4(O – H) OR (4 x 410) + 610 + 4 x 465 1640 + 610 +1860	(1)
	M4	Total = 4110 kJ	(1)
	M5	*(Use of ΔH bonds broken - ΔH bonds formed)* 3775 – 4110 (M2 – M4)	(1)
	M6	–335 kJ mol^{-1} (answer to M5, provided M5 = M2 – M4)	(1) **(6)**
(e)	(i)	yield <u>decreases</u> / equilibrium goes to the left more moles / molecules / volume on rhs *(dependent on lower yield)* or less moles etc on lhs)	(1) **(1)**
	(ii)	M1 rate increases M2 molecules/particles are closer together M3 more (frequent) collisions *(M2 and M3 are dependent on correct answer to M1)*	(1) (1) (1) **(3)**
	(iii)	yield <u>increases</u> / equilibrium goes to the right reaction is endothermic *(dependent on higher yield)*	(1) **(1)**

Total 25 marks

Question 8			
(a) (i)	M1	all have 7 / same number of electrons in the outer (valence) shell have 7 valence electrons	(1)
	M2 / M3	e.g. $H_2 + Cl_2 \rightarrow 2HCl$	(1)
		$H_2 + Br_2 \rightarrow 2HBr$	(1) **(3)**
(ii)	chlorine:	yellow green / green gas	(1)
	bromine:	red / brown / red-brown liquid	(1)
	iodine:	black / dark grey solid	(1)
		(if <u>zero</u> marks scored allow (1) mark for 3 correct colours or 3 correct physical states)	**(3)**
(iii)	With $AgNO_3$		(1)
	M1	KCl gives a white ppt	
	M2	KI gives a yellow ppt	(1)
	M3	$Ag^+ + Cl^- \rightarrow AgCl$ OR $Ag^+ + I^- \rightarrow AgI$	(1)
	With $Br_2(aq)$		(1)
	M4	Br_2 + KCl no reaction	
	M5	Br_2 + KI (red) - brown solution / black ppt	(1)
	M6	$Br_2 + 2I^- \rightarrow 2Br^- + I_2$	(1)
	M7	oxidising ability is $Cl_2 > Br_2 > I_2$	(1) **(7)**

(b) (i)	basic oxide oxide of metal reacts / dissolves with acid $MgO + 2HCl \rightarrow MgCl_2 + H_2O$ $MgO + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$ $MgO + H_2SO_4 \rightarrow MgSO_4 + H_2O$		(1) (1) **(2)**
(ii)	M1	Mg^{2+}	(1)
	M2	Cl^-	(1)
	M3	2.8 and 2.8.8 *(dependent on correct answers for M1 and M2)*	(1) **(3)**
(iii)	M1	$MgCl_2$, ionic compound / ionic bond / ionic	(1)
	M2	strong attraction between ions much energy required to separate ions	(1)
	M3	HCl, covalent compound / covalent bond / covalent	(1)
	M4	weak (attractive) forces between molecules weak intermolecular forces weak van der Waals forces little energy reuires to separate molecules	(1) **(4)**
(iv)	M1	M_r $MgSO_4.7H_2O$ 246	(1)
	M2	% of w of c (126 / 246) x 100 (126 / M1) x 100	(1)
	M3	answer = 51.2% (answer to M2 provided 126 used in M2)	(1) **(3)**

Total 25 marks

Question 9				
(a)	(i)		to prevent Ti/Na reacting with air / O_2 / N_2 to prevent oxidation of Ti / Na to provide an inert atmosphere	(1) **(1)**
	(ii)	M1	<u>NaCl</u> dissolves in water / <u>NaCl</u> is soluble in water	(1)
		M2	filter off <u>Ti</u>	(1) **(2)**
	(iii)		Sodium / Na	(1) **(1)**
(b)	(i)		$WO_3 + 3H_2 \rightarrow W + 3H_2O$	(1) **(1)**
	(ii)	M1	no pollution / water is the product / no CO_2 or CO or SO_2	(1)
		M2	H_2 is explosive / flammable	(1) **(2)**
(c)	M1		sulphur dioxide (+ water) form acid rain / is toxic / bronchial problems	(1)
	M2		carbon monoxide is toxic / attacks haemoglobin etc	(1)
	M3		carbon dioxide causes global warming / greenhouse effect	(1)
	M4		$Ca(OH)_2$ would absorb or reacts with or neutralises CO_2 and / or SO_2	(1)
	M5		calcium carbonate/calcium sulphite *(dependent on M4)*	(1) **(5)**
(d)	M1		moles CO_2 = 480/24000 = 0.02	(1)
	M2		moles of MCO_3 = 0.02 mol *(M2 is answer to M1)*	(1)
	M3		Mr = 2.50/0.02 = 125 *(M3 is 2.50 / M2)*	(1)
	M4		∴ M = 65 *(M4 = M3 – 60)*	(1)
	M5		M is zinc *(dependent on M4 and must form MCO_3)*	(1) **(5)**

(e)	A	copper(II) oxide / CuO	(1)
	B	copper(II) nitrate / $Cu(NO_3)_2$	(1)
	C	copper(II) hydroxide / $Cu(OH)_2$	(1)
	D	$[Cu(NH_3)_4(H_2O)_2]^{2+}$ / $[Cu(NH_3)_4(H_2O)_2](NO_3)_2$	(1)
	E	is nitrogen dioxide / nitrogen(IV) oxide / NO_2	(1)
M6		$CuO + 2HNO_3 \rightarrow Cu(NO_3)_2 + H_2O$	(1)
		$CuO + 2H^+ \rightarrow Cu^{2+} + H_2O$	
M7		$Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$	(1)
		$Cu(NO_3)_2 + 2NH_3 + 2H_2O \rightarrow Cu(OH)_2 + 2NH_4NO_3$	
		(accept NH_4OH)	
M8		$2Cu(NO_3)_2 \rightarrow 2CuO + 4NO_2 + O_2$	(1)
			(8)

Total 25 marks

TOTAL FOR SECTION B: 50 MARKS

TOTAL FOR PAPER: 100 MARKS

International Regional Offices at www.edexcel.com/international

For more information on Edexcel qualifications, please visit www.edexcel.com
Alternatively, you can contact Customer Services at www.edexcel.com/ask or on + 44 1204 770 696

Edexcel Limited. Registered in England and Wales no.4496750
Registered Office: One90 High Holborn, London, WC1V 7BH