OCR
RECOGNISING ACHIEVEMENT

January 2006

ADVANCED GCE UNIT

MARK SCHEME

VERSION: POST-STANDARDISATION
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MAXIMUM MARK: 90

Syllabus / Component: 2848/01

Chemistry: Chemistry of Natural Resources

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Paper Set Date: 11/01/06

SUBJECT OFFICER: Steven Evans
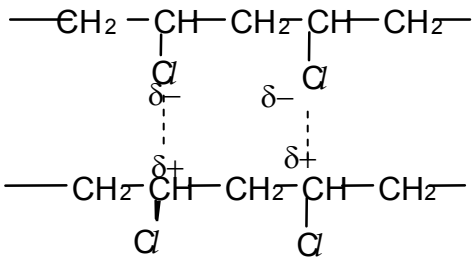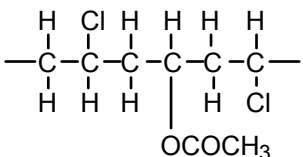
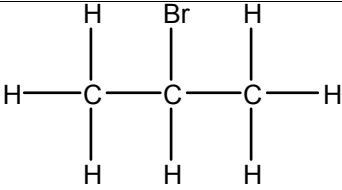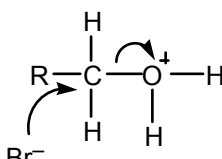| CHECKED BY	APPROVED (**Tick** or **initials** or **signature**)	DATE

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
   You are advised to destroy all draft versions.

2. Please mark all post-standardisation scripts in red ink. A tick ( ) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks (½) should never be used.

3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

   x   = incorrect response (errors may also be underlined)
   ^   = omission mark
   bod = benefit of the doubt (where professional judgement has been used)
   ecf = error carried forward (in consequential marking)
   con = contradiction (in cases where candidates contradict themselves in the same response)
   sf   = error in the number of significant figures

4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit ( ) = words which are not essential to gain credit ___ = (underlining) key words which **must** be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument

Question	Expected Answers	Marks
1 a i	air/ oxygen/O_2 (plus nothing else) (1); (blister) copper/Cu *NOT pure copper* (IGNORE +sulphur dioxide/SO_2/slag *only*) (1)	2
1 a ii	liquid/(l)/molten	1
1 a iii	1% = 1 x 1000000/100 = 10^4/10000 (1)	1
1 a iv	purification/refining/electrolysis/making brass *NOT smelting*	1
1 b i	+1 (1); 0 (1); 0 (1); +4 (1) *ALLOW 1+ and 4+ or 1 and 4 for (1)*	4
1 b ii	redox/ oxidation/ reduction	1
1 b iii	copper(I) sulphide *ignore gaps ecf from oxidation state in (i)*	1
1 c i	11 electrons (1) $4s^1 3d^{10}$ *or reversed* (1);	2
1 c ii	d/*allow D IGNORE transition metals*	1
1 d i	methyl orange/ phenolphthalein *allow small spelling errors and other suitable acid-base indicators. NOT Universal indicator or litmus*	1
1 d ii	21.2 x 0.00100/1000 (1) = 2.12 x 10^{-5} *ecf if one error* (1)	2
1 d iii	same answer as (ii)	1
1 d iv	Answer to d(iii) x 40 [2.12 x 10^{-5} x 1000/25 = 8.48 x 10^{-4} mol dm^{-3}] (1) *Do not accept rounding to 1sf.*	1
1 e	sulphur dioxide/SO_2; *plus three from* dissolves in rain/causes acid rain; damages trees/plants/ lakes/ fish/buildings/human health/ leaches aluminium; reacts with oxygen and water converts it to sulphuric acid *IGNORE greenhouse gases and photochemical smog* QWC: 2 sentences, spelling, punctuation and grammar correct (1 error) *see note* ALLOW "Sulphur dioxide" alone at the start. **Underline first two errors.**	4 1
		24

2 a	(drain)pipes/ window <u>frames (AW)</u>/ doors/ roofing *Must be part of fabric of house.*	1
2 b i	(1 -)chloroethene *correct spelling required*	1
2 b ii	electrophilic (1); addition (1) *extra selections are CON*	2
2 b iii	elimination (1)	1
2 b iv	addition (polymerisation) *NOT additional*	1
2 c i	permanent dipole-(permanent) dipole *no others*	1
2 c ii	$\partial+$, $\partial-$ correct (1); indication of attraction between correct groups(1)	2
2 d i	(or different order) (2); one error (1) *allow less displayed* *allow monomer units reversed* *connection to OCOCH₃ must be thro O*	2
2 d ii	copolymer	1
2 e	chains can slide/move over each other (AW implying relative movement) (1) intermolecular / permanent dipole-permanent dipole (*allow abbreviations*) forces weaker *(NOT fewer)* (1) working over longer distance (AW implying greater separation) (1)	3
2 f i	hydrogen (1); Ni, hot/ Pt (room t and p *ALLOW high t*) (1) *second mark depends on first*	2
2 f ii	primary (1) as OH attached to CH_2/ C with OH attached to one other C/OH at end of chain/only one R group (1)	2
2 f iii	aldehyde *ALLOW carbonyl*	1
2 f iv	(potassium/sodium) dichromate/ correct formula (1); (sulphuric) acid *IGNORE conc* (1) heat/ raised temp (*ALLOW reflux*) provided dichromate mentioned(1);	3
2 g i	M_r vinyl chloride = 62.5, ethanol = 46 (1);	1
2 g ii	moles vinyl chloride = 10/62.5 (= 0.16) moles ethanol = 1.5/46 (= 0.0326/0.033) *ecf* (1)	1
2 g iii	= moles vinyl chloride (0.16)	1
2 g iv	% = 0.0326 x 100/0.16 = 20% *(ecf, eg ALLOW 21% if 0.033 moles ethanol used)* (1) 2 sf (1) *mark separately provided number follows from some working shown*	2
2 h i	water (1); *plus one from:* catalyst with high temp and press; catalyst of sulphuric/phosphoric acid *depends on first*	2
2 h ii	yield low/ more steps/ chlorine/hydrogen chloride dangerous/ pollutant *NOT cost-related*	1

3 a i	halogenoalkane/bromoalkane (1) *ALLOW haloalkane*	1
3 a ii	(1); 2-bromopropane *ecf for 1-bromopropane* (1) *ignore positions of dashes, commas and spaces*	2
3 b i	aerosol <u>propellants</u>/ blowing agents/ refrigerants (coolants)/ air conditioning <u>coolants</u>/ fire extinguishers	1
3 b ii	*three from* not broken down/ unreactive in troposphere; broken down (AW) in stratosphere; by <u>high energy/frequency</u> uv/radiation; which cause homolytic fission/photodissociation chlorine atoms/radicals; break down ozone - catalysis implied *two from* C–Br bond weaker (than C–Cl); can be broken by lower energy/ frequency uv/visible/light/radiation; *or* contains C–H bonds; which cause it to be more reactive broken down/react in troposphere/before reaching stratosphere. QWC Logical and at least three words from list used correctly troposphere, stratosphere, uv, radiation, radical, catalyse/catalyst, homolytic fission, photodissociation	6
3 b iii	*two from* boiling point/volatility; flammability; toxicity/harm to health; cost <u>of manufacture (AW);</u> (un)reactivity/stability/ease of disposal. *IGNORE greenhouse gases* **Mark all suggestions**	2
3 c i	$CH_3CH_2CH_2OH/C_3H_7OH/C_3H_8O$. *ALLOW propan-1-ol if formula correct in equation*	1
3 c ii	$CH_3CH_2CH_2OH$ (*etc as above)*(l/aq) + HBr (g/aq) → $CH_3CH_2CH_2Br$ (*etc)*(l/aq) + H_2O (l) (1) for equation correct; *ecf for incorrect R group* (1) for state symbols (*if first mark scored*)	2
3 c iii	(anhydrous) sodium sulphate/ *other suitable salt (unless clearly hydrated)*/silica gel *NOT conc sulphuric, soda lime*	1
3 c iv	(fractional) distillation	1
3 c v	 intermediate complete (*ignore +)* ALLOW + on C (1); bromide attack (1); arrow from bond to O$^{(+)}$ (1)	3

4 a	alternative hydrocarbons (eg diesel)/ oxygenates/ lean burn engines/ more complete combustion (AW)/ hybrid engines/ fuel injection/oxygen sensors /reduced drag/ lighter cars (AW)	1
4 b	wind power/ wave power/ tidal power/ biomass/ nuclear/ geothermal/ hydroelectric/ solar power/cells/panels	1
4 c i	Sun (1); uv/visible / high frequency/ high energy end of spectrum/ between visible and X-ray (1)	2
4 c ii	makes bonds/molecules vibrate (more) (1); turned into kinetic energy/ move around faster which increases temperature (1)	2
4d i	Increased CO_2 levels in troposphere/CO_2(g) moves <u>equilibrium</u> (position) in **equation 4.1** to right* (1) Increased CO_2(aq) moves <u>equilibrium</u> (position) of **equation 4.2** to right* (1) *or <u>equilibrium</u> producing identified products "equilibrium moves to right" scores 1 of first 2 HCO_3^- increases (1)	3
4 d ii	rate of forward reaction = rate of back reaction (1); *and one from:* <u>concentrations</u> of reactants and products remain constant ; closed system	2
4 d iii	system not closed/ CO_2(g) moves away from surface/CO_2(aq) ionises (AW)	1
4 e	SiO_2 giant covalent/ network solid/ lattice/ whole structure held together by covalent bonds (1) *IGNORE "intermolecular"* CO_2 molecular (AW) (1) <u>weak</u> intermolecular forces (*can be named and can be abbreviated ALLOW permanent dipole - permanent dipole*)/less energy needed to separate molecules/ bonds in SiO_2 are stronger (1)	3
		15