

GCE

Edexcel GCE

Chemistry (Nuffield) (6252/01)

January 2006

advancing learning, changing lives

Mark Scheme (Results)

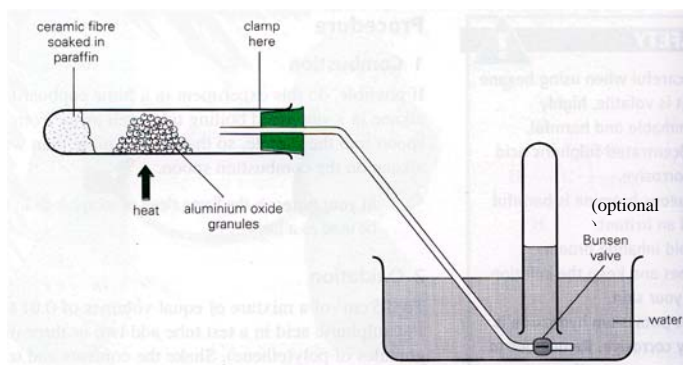
Edexcel GCE
Chemistry (6252/01)

Section A

| | | | | |
|----|-----|------|---|----------|
| 1. | (a) | (i) | $ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}=\text{C} \\ \quad \quad \\ \text{H} \quad \quad \text{H} \end{array} $ | (1 mark) |
| | | (ii) | $ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \times \bullet \quad \circ \times \quad \bullet \bullet \times \\ \text{H} \bullet \times \quad \text{C} \bullet \quad \circ \quad \text{C} \quad \circ \bullet \bullet \times \\ \bullet \times \quad \quad \quad \bullet \bullet \times \\ \text{H} \quad \quad \quad \text{H} \quad \quad \quad \text{H} \end{array} $ <p> <i>ALLOW all dots or crosses</i> <i>ALLOW TE for a butene/pentene in (a)(i)</i> <i>IGNORE circles</i> </p> | (1 mark) |

(b)

Liquid



ceramic fibre / glass or mineral/cotton wool soaked in (liquid) paraffin (1)
NOT wire wool

aluminium oxide / Al_2O_3 / pumice/ porcelain/broken pot etc. in correct position in tube (1)

heat directed at solid - must be under some of solid (1)

collection over water/gas syringe (1)

If Bunsen valve shown it must be under the test tube

Tubing following valve must be closed unless under test tube

ACCEPT no tubing after valve

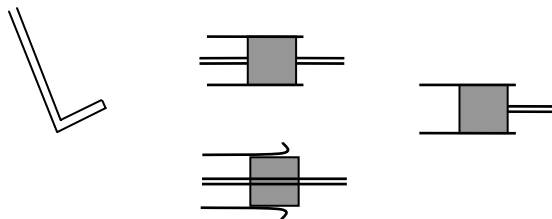
Penalties -1 for each (to a maximum of two penalties)

apparatus will not "work" , eg no bung, open tube not under test-tube, even following Bunsen valve

error in gas collection eg delivery tubing through trough or test-tube

delivery tubing shown as single line

ALLOW



(4 marks)

(c)

(i)

orange/brown/yellow to colourless NOT 'clear'
Any mention of red (0)

(1 mark)

(ii)

$\text{CH}_3\text{CHBrCH}_2\text{Br}$
ALLOW $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{Br}$ *OR* $\text{CH}_3\text{CHBrCH}_2\text{OH}$
ALLOW displayed/semi-displayed formulae

(1 mark)

| | | | |
|-----------------------------|-----|---|-----------|
| | (d) | (i) (yield/amount/it) decreases / more propane formed (1) Fewer (gas) molecules/ moles on left than on the right <i>OR</i> reaction goes to side with fewer molecules/ moles (1) <i>NOT</i> "equilibrium moves to the left" <i>Mark independently</i> | (2 marks) |
| | | (ii) endothermic process / K_p increases/heat taken in/ $\Delta S_{\text{surroundings}}$ becomes less negative/increases | (1 mark) |
| | | (iii) none / same yield | (1 mark) |
| | (e) | $(\text{CH}_3)_2\text{C}=\text{CH}_2$ <i>ALLOW displayed formula (1)</i> <i>ALLOW</i> $\text{C}(\text{CH}_3)_2=\text{CH}_2$ $\text{CH}_3\text{C}(\text{CH}_3)=\text{CH}_2$ $\text{CH}_3\text{CCH}_3=\text{CH}_2$ $\text{CCH}_3\text{CH}_3=\text{CH}_2$ $\text{CH}_3\text{CH}_3\text{C}=\text{CH}_2$ <i>double bond need not be shown, but if single bond displayed (0)</i> (2-)methylpropene (1) 2-methylprop-1-ene 2-methylprop-2-ene } <i>IGNORE punctuation, spaces etc</i> <i>Mark independently</i> <i>No transferred error allowed</i> | (2 marks) |
| Total for question:14 marks | | | |

| | | | |
|----|-----|--|-----------|
| 2. | (a) | $\Delta H_{\text{at}} = (2 \times 347) + 612 + (8 \times 413) = + 4610 \text{ (kJ mol}^{-1}\text{)}$ <p>Method (2) Answer (arithmetic and sign) (1)</p> <p>+ 4610 <i>with no working</i> (3) <i>one multiple wrong/omitted (eg +4263/+1719) 2 max</i> <i>two multiples wrong/omitted (eg +1372) 1 max</i></p> | (3 marks) |
| | (b) | <p>(i) axes suitably labelled with units : "(Number of) carbon atoms" on x-axis and "ΔH_{at} (/) kJ mol^{-1}" on y-axis (1)</p> <p>Linear and sensible scales (1) <i>ALLOW one big square per 1000 kJ. Must be one big square per carbon atom</i></p> <p>All points correctly plotted and joined with straight line or dot-to-dot (1) <i>only penalise if points clearly off line</i></p> <p><i>Graph of ΔH_{at} vs. Boiling point (0)</i> <i>Graph of Boiling point vs. number of carbon atoms (0)</i></p> | (3 marks) |
| | | <p>(ii) <i>1st mark: bond breaking increasing</i> <i>2nd mark: quantitative treatment</i></p> <p>e.g. (From one alkene to the next) involves the atomisation/breaking of an extra C-C bond and two extra C-H bonds (2)</p> <p><i>OR</i> a need to break more bonds as chain length increases (1) molecules increase by $-\text{CH}_2-$ as chain length increases (1)</p> | (2 marks) |
| | | (iii) (+) $4620 \pm 30 \text{ (kJ mol}^{-1}\text{)}$ | (1 mark) |

| | | | | |
|--|-----|-------|---|-----------|
| | (c) | (i) | Van der Waals <i>OR</i> fluctuating/induced dipoles <i>OR</i> London/dispersion forces <i>NOT</i> vdw | (1 mark) |
| | | (ii) | Number of electrons increases (1) so the strength of the van der Waals / intermolecular forces also increases <i>OR</i> so there are more van der Waals forces (1) <i>Mark independently</i> | (2 marks) |
| | | (iii) | Two geometric isomers [<i>can be shown in diagram instead</i>]/ a cis and trans form exist <i>OR</i> Valid argument based on no free rotation about C=C bond → two isomers | (1 mark) |
| | | (iv) | Pent-1-ene because unbranched/straight chain (1) Greater area (of contact)/more contact between molecules/molecules can align more easily (1) <i>IGNORE</i> argument based on stacking/packing <i>IGNORE</i> molecules can get closer together | (2 marks) |
| | (d) | | There is hydrogen bonding in water (1) Alkenes cannot form hydrogen bonds (with water molecules)/alkene-water interactions too weak (1) <i>Mark independently</i> | (2 marks) |
| | | | Total for Question: 17 marks | |

| | | | | |
|----|-----|-------|--|-----------|
| 3. | (a) | (i) | $\text{Cl}_2(\text{aq}) + 2\text{I}^-(\text{aq}) \longrightarrow 2\text{Cl}^-(\text{aq}) + \text{I}_2(\text{aq/s})$ <i>OR halved version</i> Entities (1) Balancing and state symbols (1) <i>2nd mark dependent on 1st unless spectator ions included on both sides of equation</i> | (2 marks) |
| | | (ii) | Purple/pink/violet/mauve/lilac <i>OR any combination of these colours</i> <i>Can be prefixed by deep or dark</i> <i>Any mention of red (0)</i> | (1 mark) |
| | | (iii) | Orange <i>OR</i> yellow <i>ALLOW</i> red <i>OR</i> brown <i>ALLOW any combination of these colours</i> | (1 mark) |
| | (b) | (i) | iodine in I_2 : 0 iodine in I^- : -1 (1) sulphur in SO_2 : +4 sulphur in SO_4^{2-} : +6 (1) | (2 marks) |
| | | (ii) | sulphur dioxide / SO_2 , because of sulphur's increased oxidation number/losing electrons <i>ALLOW</i> because sulphur dioxide gains oxygen <i>[both parts needed for the mark]</i> <i>ALLOW reverse argument ie iodine gains electrons/oxidation number decreases</i> | (1 mark) |
| | | (iii) | $\text{I}_2(\text{aq}) + \text{SO}_2(\text{aq}) + 2\text{H}_2\text{O} \rightarrow 2\text{I}^-(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) + 4\text{H}^+(\text{aq})$ <i>ALLOW multiples</i> | (1 mark) |

| | | | | |
|--|-----|-------|---|-----------|
| | (c) | (i) | the red colour would interfere with the colour change at the end-point <i>OR</i> so that the colour of the indicator/the end-point can be seen/determined | (1 mark) |
| | | (ii) | colourless to (deep/dark) blue / blue-black / black <i>Any mention of purple (0)</i> | (1 mark) |
| | | (iii) | <ul style="list-style-type: none"> • moles of iodine = $\frac{(12.2)}{1000} \times 0.001 = 1.22 \times 10^{-5} / 0.0000122$ (1) • moles of sulphur dioxide = 1.22×10^{-5} (1) <p><i>ALLOW answer equal to or a single digit multiple of answer above</i></p> <ul style="list-style-type: none"> • concentration of SO₂ = $1.22 \times 10^{-5} \times \frac{(1000)}{25} = 4.88 \times 10^{-4} / 0.000488$ (mol dm⁻³) (1) <i>OR</i> $4.9 \times 10^{-4} / 0.00049$ (mol dm⁻³) <p><i>ALLOW TE from answer above</i> <i>IGNORE units</i></p> | (3 marks) |
| | | (iv) | activated charcoal might react with / adsorb SO ₂ / (traces of) charcoal might react with I ₂ (thus giving an underestimate of [SO ₂] in the wine) | (1 mark) |
| | | | Total for Question: 14 marks | |
| | | | Total for Section A: 45 marks | |

| SECTION B | | | |
|-----------|-----|---|----------|
| 4. | (a) | N ₂ O | (1 mark) |
| | (b) | Refrigerants/heat transfer agents and anaesthetics/they share similar properties <i>OR</i> properties exemplified eg non flammable/non toxic/volatile - <i>any two of these</i> <i>OR</i> Refrigeration technology resulted in the production of CFCs which were then found to have properties of anaesthetics <i>OR</i> Refrigerants/heat transfer agents were found to be anaesthetics | (1 mark) |
| | (c) | Inertness of fluorine in the C-F bond Inertness of fluorine in the CF ₂ / CF ₃ groups CF/CF ₂ /CF ₃ group conferred stability on adjacent/neighbouring C–Hal bonds <i>NOT</i> inertness of C-F bond/fluorine alone | (1 mark) |
| | (d) | (i) There is a greater difference between the electronegativities of fluorine and hydrogen than between fluorine and chlorine / chlorine is more electronegative than hydrogen <i>Answer in terms of relevant relative shifts in electron densities are acceptable.</i> <i>ACCEPT answers based on relative symmetries, e.g. electron cloud in CF₃CCl₃ is more symmetric than with CF₃CH₂Cl</i> <i>ACCEPT argument in terms of electropositivities</i> | (1 mark) |
| | | (ii) CF ₃ CH ₂ Cl because it possesses C-H bonds <i>OR</i> enables (electrostatic) interactions with "brain molecules" <i>OR</i> because a lower dose can be used | (1 mark) |
| | (e) | (2)-bromo-(2)-chloro -1,1,1-trifluoroethane <i>OR</i> (1)-bromo-(1)-chloro-2,2,2-trifluoroethane } <i>IGNORE punctuation</i> <i>ACCEPT non alphabetic versions</i> <i>NOT</i> bromochlorotrifluoroethane | (1 mark) |
| | (f) | 100-106.5 ° <i>Any value or range of values within this range</i> | (1 mark) |

| | | |
|--|--|--|
| | <p>(g) Examiners will need to consider each answer for (i) key points and (ii) style and use of English. Candidates should have recorded their word total at the end of their answer, and this should be checked.</p> <p>up to 105 words: no penalty 106 - 115 words: -1 116 - 125 words: -2 126 - 135 words: -3</p> <p>and at a rate of -1 penalty for every 5 words excess thereafter, up to a maximum penalty equal to the number of key points included by the answer.</p> <p>Note that words appearing in the title to the summary do not count in the word total. Normally hyphenated words, numbers and chemical formulae count as one word. The question does not ask for equations in the summary, but if included they should be counted in the word total.</p> <p>Marking for key points One mark should be awarded for every key point clearly identified in an answer.</p> <p style="text-align: center;">Key points minus word penalty = maximum 6 marks</p> <p>To gain the mark for a key point the wording used by the candidate must make clear the essential chemistry of the point.</p> | |
|--|--|--|

| | | | | |
|--|---|---|--|------------------|
| | | Key points | | |
| | | Advantages of using halothane: Any 5 (max) of these key points | | |
| | 1 | Halothane is non/less flammable/ non explosive/toxic. <i>ALLOW inverse argument with reference to CHCl₃, ether or 'earlier anaesthetics'</i> | | (1) |
| | 2 | It does not cause gastric irritation / post operative vomiting. <i>ALLOW inverse argument with reference to CHCl₃, ether or 'earlier anaesthetics'</i> | | (1) |
| | 3 | It is not thought to cause irreversible liver damage with repeated dosage. <i>ALLOW inverse argument</i> | | (1) |
| | 4 | Halothane contains a C-Br /bromine / C-H bond, so is safer (to use than other CFCs). <i>ALLOW inverse argument</i> | | (1) |
| | 5 | Halothane produces narcosis /anaesthesia/deep sleep at low(er) doses/concentrations (than other CFCs) <i>OR</i> halothane does not need high dose which lead to breathing paralysis. | | (1) |
| | 6 | Halothane (was a potent inhalation agent) with a smooth, pleasant induction (period for the patient). | | (1) |
| | | <u>Why halothane's use declined:</u> | | |
| | 7 | Halothane is associated with post-operative liver dysfunction. | | (1) |
| | 8 | Safer and cheaper anaesthetics/agents (such as enflurane and isoflurane) were discovered. | | (1) |
| | | | | (6 marks) |

| | | | |
|--|--|--|------------------------------|
| | | <p>Quality of Written Communication</p> <p>These should <i>be impression</i> marked on a scale 2-1-0, and the mark out of 2 should be recorded in the body of the script at the end of the answer. This mark can not be lost as a result of a word penalty.</p> <p>Candidates are expected to:</p> <ul style="list-style-type: none"> • show clarity of expression; • construct and present coherent argument; • demonstrate effective use of grammar punctuation and spelling. <p>The aspects to be considered are:</p> <ul style="list-style-type: none"> • use of technical terms; the answer should convey a correct understanding by the writer of the technical terms used in the passage which are involved in the key points. • articulate expression; the answer should be well-organised in clear, concise English, without ambiguity. It should read fluently, with the links between key points in the original maintained. • legible handwriting; the reader should be able to read the answer without difficulty at normal reading pace, with only the occasional difficulty with a word. • points must be in a logical order. <p>Good style and use of English, with only infrequent minor faults, no use of formulae (2)</p> <p>Frequent minor or a few major faults in style and use of English (1)</p> <p>Very poor style and use of English (0)</p> <p>NB: The quality of written communication mark cannot be lost through word penalties.</p> | (2 marks) |
| | | | Total for Section B:15 marks |
| | | | Total for paper: 60 marks |