CAMBRIDGE
INTERNATIONAL EXAMINATIONS

CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the November 2003 question papers

0620 CHEMISTRY	
0620/01	Paper 1 (Multiple Choice), maximum mark 40
0620/02	Paper 2 (Core), maximum mark 80
0620/03	Paper 3 (Extended), maximum mark 80
0620/05	Paper 5 (Practical), maximum mark 40
0620/06	Paper 6 (Alternative to Practical), maximum mark 60

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the November 2003 question papers for most IGCSE and GCE Advanced Level syllabuses.

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Grade thresholds taken for Syllabus 0620 (Chemistry) in the November 2003 examination.

	maximum mark available	minimum mark required for grade:			
		A	C	E	F
Component 1	40	-	28	22	18
Component 2	80	-	58	45	36
Component 3	80	46	28	-	-
Component 5	40	28	22	17	13
Component 6	60	44	34	25	19

The threshold (minimum mark) for B is set halfway between those for Grades A and C.
The threshold (minimum mark) for D is set halfway between those for Grades C and E.
The threshold (minimum mark) for G is set as many marks below the F threshold as the E threshold is above it.
Grade A* does not exist at the level of an individual component.

CAMBRIDGE
INTERNATIONAL EXAMINATIONS

November 2003

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 0620/01

CHEMISTRY

(Multiple Choice)

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Question Number	*Key*	*Question Number*	*Key*
1	**A**	21	**D**
2	**D**	22	**A**
3	**B**	23	**C**
4	**C**	24	**A**
5	**B**	25	**B**
6	**D**	26	**B**
7	**A**	27	**B**
8	**C**	28	**A**
9	**B**	29	**D**
10	**B**	30	**D**
11	**B**	31	**D**
12	**D**	32	**B**
13	**A**	33	**A**
14	**D**	34	**C**
15	**D**	35	**B**
16	**B**	36	**A**
17	**C**	37	**C**
18	**C**	38	**A**
19	**C**	39	**B**
20	**C**	40	**B**

CAMBRIDGE
INTERNATIONAL EXAMINATIONS

November 2003

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 0620/02

CHEMISTRY
Core

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1 (a) (i) B [1]

(ii) A [1]

(iii) C [1]

(iv) D [1]

(b) (i) distillation [1]
ALLOW: fractional distillation

(ii) chromatography [1]

(c) (i) fuel gas [1]

(ii) paraffin: any one of:
oil stoves/heaters/for heating; aircraft fuel; [1]
ALLOW: for lamps/for lighting/for cooking
bitumen: any one of:
road surfaces; ALLOW: for roads
roofing tar; NOT: 'tar' without qualification
in/for electrical cables; NOT: electrical cables [1]

(d) hydrocarbons [1]

(e) correct structure with correct pairings of dots and crosses [2]
(correct structure with only dots or only crosses/random dots/crosses = 1)
IGNORE: lack of inner electron shell of carbon

(f) alkane(s) [1]

Total = 13

2 (a) respiration [1]

(b) (i) lighted splint/put mouth of test tube of hydrogen in flame;
pops/explosion [2]

(ii) makes explosive mixture [1]

(iii) (red) litmus paper/universal indicator paper/pH paper;
turns blue [2]
ALLOW: HCl gas/HCl on glass rod; white fumes

(c) correct displayed/geometric formula for ethanoic acid [1]
(all bonds must be shown)

(d) (i) $2H_2$ [1]

(ii) fuel/<u>making</u> ethyne/<u>making</u> carbon black/<u>making</u> synthesis gas/
<u>making</u> methanol [1]
NOT: natural gas
NOT: cooking

(iii) 1st and 3rd boxes ticked [2]
1 box correct = 1 mark

(e) **(i)** zinc [1]

(ii) iron/nickel [1]
ALLOW: zinc

(iii) lead [1]

(iv) calcium carbonate [1]

(v) aluminium [1]

Total = 16

3 **(a)** In iron making
ALLOW: in blast furnace/for neutralising acid soils or acidic lakes etc./for building/making cement OR concrete/hard core/road foundations [1]
NOT: removing impurities from iron ore
NOT: purification of water

(b) $C + O_2 \rightarrow CO_2$
correct formula for oxygen;
correct formula for carbon dioxide [2]
(-1 per other error)
ALLOW: $2C + O_2 \rightarrow 2CO$ (2 marks)

(c) exothermic [1]
NOT: combustion

(d) calcium oxide;
carbon dioxide [2]
NOT: symbols

(e) **(i)** 2 (HCl) [1]

(ii) limewater;
turns milky/cloudy [2]

(f) **(i)** oxidation;
the carbon has gained oxygen/oxidation number of carbon has increased/carbon has lost electrons [2]
(the answer must refer to the carbon)
NOT: carbon gets oxidised

(ii) blowtorches/welding/cutting metals [1]
ALLOW: to make (monomers for) neoprene/synthetic rubber
NOT: other organic syntheses

Total = 12

4 (a) halogen(s) [1]

(b) (i) (atoms with same atomic number) but different mass number/different numbers of neutrons/different nucleon number [1]
NOT: atoms with different atomic masses

(ii) 35 + 35 [1]
44; 46 [2]
35 + 35 [1]

(c) (i) chlorine more reactive (than bromine)/higher in the reactivity series (than bromine) (or reverse argument) [1]
ALLOW: it is more reactive
NOT: chlorine higher in the table

(ii) potassium bromide + chlorine → potassium chloride + bromine [1]
ALLOW: completely correct symbol equation

(d) (i) 3.5 [1]
ALLOW: 3.3- 3.5

(ii) pH 3 [1]

(iii) pH 7 [1]

(e) bromine (water) decolourised/goes from red-brown/orange/brown to colourless [1]
ALLOW: it is decolourised
NOT: incorrect colours to colourless

Total = 12

5 (a) 5 (O_2) [1]

(b) anhydrous/white copper sulphate;
turns blue [2]
OR
anhydrous/blue cobalt chloride;
turns pink
NOT: boiling point 100°C

(c) 1st and 2nd boxes ticked [2]

(d) (i) carbon monoxide [1]

(ii) incomplete combustion of the fuel/gas/burning in limited amount of oxygen/air [1]
NOT: incomplete burning
NOT: lack of air

(e) (i) gas [1]

(ii) coal [1]

(iii) any two of:
erodes buildings containing (calcium) carbonate OR erodes/corrodes metals in buildings;
NOT: corrodes (calcium) carbonate
kills (small) animals in water OWTTE/kills pond life;
(NOT: kills animals)
damages trees/plants/causes leaf burn/damages plant roots; [2]
ALLOW: kills plants
NOT: causes breathing difficulties
NOT: destroys buildings/wildlife/plants/animals

(iv) white;
precipitate/solid [2]

Total = 13

6 (a) aluminium high in reactivity series/too reactive [1]
ALLOW: aluminium higher in reactivity series than carbon
ALLOW: carbon will not reduce aluminium oxide

(b) electrical heating [1]
NOT: heating

(c) conducts electricity/ [1]
ALLOW: good conductor
NOT: has high melting point/inert/unreactive

(d) cathode [1]

(e) saves energy/too much energy required to melt aluminium oxide;
ALLOW: too much heat required/electricity OR heat is expensive
NOT: unqualified 'expensive':
will not melt the steel casing [2]
ALLOW: melting point is higher than steel
NOT: melting point too high

(f) any two of :
oxygen reacts with the carbon/graphite/(positive) electrode/anode gets oxidised;
carbon dioxide formed;
carbon electrodes/anodes decrease in size/get eroded away [2]
ALLOW: anodes get eaten away/wear away
NOT: anodes dissolve

(g) $3\ e^-$ [1]
ALLOW 3e

(h) positive ions attracted to negative electrode/positive charges attracted to negative/aluminium has oppositely charged ions to the negative electrode;
ALLOW: aluminium ions are positive [1]

(i) 60% [1]

(ii) 3 from:
malleable;
ductile;
sonorous;
shiny;
conduct heat;
conduct electricity [3]
ALLOW: flexible/bendy
NOT: high melting/boiling points/high densities

Total = 14

CAMBRIDGE
INTERNATIONAL EXAMINATIONS

November 2003

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 0620/03

CHEMISTRY
Extended

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- An incorrectly written symbol, e.g.NA **or** CL, should be penalised once in a question.

In the mark scheme if a word **or** phrase is underlined it(**or** an equivalent) is required for the award of the mark.
(.....) is used to denote material that is not specifically required.
OR designates alternative and independent ways of gaining the marks for the question.
or indicates different ways of gaining the same mark.
cond indicates that the award of this mark is conditional upon a previous mark being gained.

- Unusual responses which include correct Chemistry that answers the question should always be rewarded - even if they are not mentioned in the marking scheme.
- All the candidate's work must show evidence of being marked by the examiner.

1 (a) (i) different boiling points [1]

(ii) methane **or** water **or** petroleum **or** named petroleum fraction **or** alkane
Any TWO [2]

(b) (i) volume decrease for forward reaction **or** fewer moles of gas on products side [1]
favoured by increase in pressure [1]
or increase in pressure moves position of equilibrium to right

(ii) increase [1]
exothermic reaction favoured by lower temperature [1]

(iii) 300 to 600 ^{0}C
1:3 volume ratio
iron (catalyst)
150 to 300 atm
Any TWO [2]

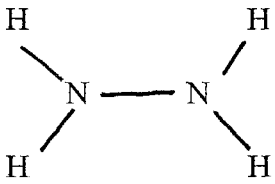
(c) (i) proton [2]
hydrogen <u>ion</u> **or** H^+ **ONLY** [1]

(ii) correct equation molecular **or** ionic [1]
$NH_3 + HCl = NH_4Cl$
$NH_3 + H^+ = NH_4^+$ accept NH_4OH

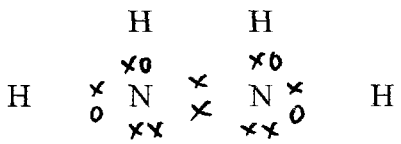
(d) measure pH **or** add universal indicator **or** pH meter [1]
ammonia has lower pH if numerical values given

must be appropriate that is above 7 with ammonia having the lower value **or** correct colours, green and blue are acceptable [1]
OR measure conductivity [1]
ammonia has poorer conductivity [1]

(e) (i) correct structural formula [1]



(ii) 8e around nitrogen [1]
2e around each hydrogen [1]



TOTAL = 17

2 (a) (i) 40 [1]
80 **or** 40 [1]
1 [1]

(ii) particles have more energy **or** moving faster [1]
collide more frequently
or collide with more energy [1]

(iii) greater surface area [1]

(iv) flour mills **or** coal mines **or** metal powders [1]
or fireworks **or** gunpowder

(b) (i) collect and measure volume of oxygen [1]
or mass **or** count bubbles
time [1]

(ii) measure rate in different light levels and comment [1]
accept if dark no reaction

(c) (i) $+6O_2$ [2]
not balanced that is just O_2 **ONLY** [1]

(ii) linkage ---O---- [1]
chain [1]
minimum to be accepted

TOTAL = 14

3 (a) (i) heat **or** roast [1]
in air [1]

(ii) Either correct equation [2]
$ZnO + C = Zn + CO$
$2ZnO + C = 2Zn + CO_2$
Not balanced **ONLY** [1]
NOT carbon monoxide as a reductant

(iii) bp of lead above 1400 ^{0}C it remains
bp of zinc below 1400 ^{0}C
boils away **or** forms vapour
Any TWO [2]

OR lead does not boil [1]
zinc boils [1]

(b) (i) making brass **or** any zinc containing alloy **or** galvanising [1]
or sacrificial protection **or** batteries **or** roofs

(ii) lattice **or** layers of (positive) ions
delocalised **or** free **or** mobile electrons
layers/atoms/particles can slip [3]

(iii) different size atom **NOT** shape [1]
prevents layers from moving [1]

(c) (i) one involving lead – change 2 [1]
cond because electrons are gained [1]
or oxidation number less

(ii) correct equation [2]
$Zn + 2Ag^+ = 2Ag + Zn^{2+}$
not balanced **ONLY** [1]

TOTAL = 16

4 (a) (i) in which something dissolves [1]

(ii) correct formula [1]
$CH_3COOC_2H_5$ **or** full structural formula

NOT $C_4H_8O_2$

(iii) steam **or** water **or** hydration [1]
heat **or** catalyst [1]

OR bubble into (concentrated) sulphuric acid [1]
add water [1]

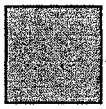
oxidised [1]
by air **or** dichromate **or** manganate(VII) [1]

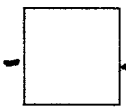
(iv) ethanoic acid and butanol [1]

(b) (i) CH_2OH [1]
CHOH
CH_2OH

(ii) soap **or** detergent [1]

(c) (i) polyester **or** condensation polymer **NOT** terylene [1]

(ii) HOOC –  –COOH [1]

HO –  – OH [1]

If wrong way around [1] Point of attachment of functional group to "box" not important

(d) (i) protein **or** poly peptide **or** polyamide [1]
(ii) peptide **or** amide [1]
(iii) amino acids are colourless **or** become visible/coloured **or** to develop it [1]
(iv) using colour **or** from position **ONLY** [1]
OR discussion of Rf [2]
OR compare with known amino acids [2]

TOTAL = 17

5 (a) (i) preserve food **or** sterilising [1]
(ii) making paper [1]

(b) (i) making sulphuric acid **or** Contact Process [1]

(ii) oxygen [1]

(iii) vanadium oxide as catalyst (ignore oxidation state)
400 to 500 °C
pressure less than 10 atm
Any TWO [2]

(c) (i) pink **or** purple [1]
colourless **NOT** clear [1]

(ii) barium sulphate [1]
cond bromine oxidises **or** reacts with [1]
sulphur dioxide to form sulphate ion [1]

(d) the number of moles of SO_2 in the mixture = 0.125
the number of moles of Cl_2 in the mixture = 0.2
cond reagent was not in excess? SO_2
cond moles of SO_2Cl_2 formed = 0.125
cond the mass of sulphuryl chloride formed = 16.9g
[5]

TOTAL = 16

TOTAL for PAPER = 80

CAMBRIDGE
INTERNATIONAL EXAMINATIONS

November 2003

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 0620/05

CHEMISTRY
Practical

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Question Number				Part Mark
1		Times recorded in seconds in table	(1)	
		Times increasing in magnitude	(1)	
		Comparable to Supervisor's results	(2)	4
	(a)	Suitable scale for time/s	(1)	
		Points plotted correctly	(2)	
		-1 for each incorrect		
		Smooth line graph	(1)	4
	(b)	colourless	(1)	
		to blue/purple	(1)	2
	(c)	Estimate read from graph	(1)	
		Unit	(1)	2
		Indication correct on graph	(1)	1
	(d) (i)	Experiment 1	(1)	1
	(ii)	Greatest concentration of bromate	(1)	
		therefore more collisions	(1)	2
	(e) (i)	Two sources of error	(2)	
		e.g. inaccurate measurement of named liquid into beaker/stopping timer at same colour level/timing problem – <u>not</u> use of timer		2
	(ii)	Two improvements	(2)	
		e.g. use a burette/use a colorimeter/read and average		2
				Sub-total = 20
2	(a)	yellow/brown/orange	(1)	1
	(b) (i)	orange/brown	(1)	
		precipitate	(1)	
		remains/insoluble in excess	(1)	3
	(ii)	Litmus → blue/indicator pH > 7	(1)	
		smell of gas	(1)	2
	(c)	orange/brown	(1)	
		precipitate	(1)	
		remains/insoluble in excess	(1)	3

(d)	fizz/bubbles etc	**(1)**	
	lighted splint	**(1)**	
	pops	**(1)**	**3**
	green	**(1)**	
	precipitate	**(1)**	
			2
(e)	white	**(1)**	
	precipitate	**(1)**	
			2
(f)	iron(III) = 2 marks, iron only = 1 mark	**(2)**	
	ammonium	**(1)**	
	sulphate	**(1)**	
	or correct formulae		**4**
			Sub-total = 20
			Total for paper = 40

CAMBRIDGE
INTERNATIONAL EXAMINATIONS

November 2003

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 0620/06

CHEMISTRY
Alternative to Practical

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Question Number	Question (Including any Source Details)	Part Mark
1 (a)	Boxes labelled clockwise: Condenser (1) Beaker (1) Fractionating column (1)	3
(b)	↑ underneath flask (1)	1
(c)	Fractional (1) distillation (1)	2
2 (a)	Larger surface area (1) Quicker to extract colour/more colour extracted (1) not easier/faster	2
(b)	Reference to ethanol (1)	1
(c)	Reference to flammability of ethanol (1)	1
(d)	To prevent loss of solvent (1) not splash/evaporation	1
(e)	Pour off liquid (1)	1
(f)	Chromatography (1) Apply orange concentrate (1) to paper (1) Use of solvent (1) Description of elution (1) Result of experiment (1) Max 5 – all marks could be obtained from a suitable diagram	5
3	Table. Times read correctly: 4s (1) 8s (1) 14s (1) 30s (1) 82s (1)	5
(a)	Points plotted correctly (3) (-1 for each incorrect) Smooth line graph (1)	4
(b)	Read from graph – should be ≃ 48 (1) s (1) Indication on graph (1)	2 1
(c) (i)	Experiment 1 (1)	1
(ii)	Greatest concentration/amount of bromate (1) Therefore more collisions (1)	2

Question Number	Question (Including any Source Details)	Part Mark
(d) (i)	Two errors: e.g. use of m cylinder inaccurate (1)/use of timer (1)/detecting when cross not visible	2
(ii)	Improvements: e.g. use of burette (1)/use of computer data logging (1)/use of colourimeter (1) insulate repeat and average	2
4 (b) (i)	Orange/brown (1) Precipitate (1) No change in excess (1)	3
(c)	Orange/brown precipitate (1) No change in excess (1)	2
(f) (i)	Hydrogen (1)	1
(ii)	Reduction/redox/displacement (1) iron (II) formed (1)	2
(g)	Cation – ammonium (1) Anion – sulphate (1)	2
5 (a)	Sodium hydroxide (1)	1
(b)	Ammonium sulphate (1)	1
(c)	Bunsen burner (1)	1
(d)	Reference to reaction (1)	1
(e)	Gas jar wrong way up (1) Gas is less dense than air (1)	2
	Tubes in flask should be evened (1) Liquid would be transferred to gas jar (1)	2
	Also credit in **(c)**	
6	Weigh coal sample (1) same amount Burn coal (1) Pass gas or diagram to show (1) Through acid/dichromate (1) Use of timer (1) Record time for colour change (1) Repeat/compare with other samples (1)	
	Max 6	6
		Total 60