UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the June 2004 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 discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.

Grade thresholds taken for Syllabus 0620 (Chemistry) in the June 2004 examination.

	maximum mark available	minimum mark required for grade:			
		A	C	E	F
Component 1	40	-	26	20	17
Component 2	80	-	52	36	27
Component 3	80	53	31	-	-
Component 5	40	31	24	18	14
Component 6	60	42	32	21	15

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.

June 2004

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

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INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 0620/02

CHEMISTRY

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1 (a) B, C, F (all needed); [1]
Only contain one type of atom [1]
NOT: contain one kind of molecule
NOT: cannot be split using chemical means

(b) C [1]

(c) (i) B [1]

(ii) any gas with diatomic molecules e.g. chlorine, hydrogen, hydrogen chloride [1]

(d) (i) F [1]

(ii) pencil 'leads'/in pencils/lubricant/in electrical conductors/for electrodes/ in tennis racquets/in golf clubs/hockey sticks etc [1]

(e) (i) substance containing 2 or more different atoms combined/bonded/joined (both parts needed for mark) [1]
ALLOW: elements (chemically) combined

(ii) methane [1]

(f) (i) 8 electrons round chlorine and bonded pair with dot and cross = 2 [2]
ALLOW: all dots or all crosses
Correct number of electrons but bonded pair not clearly on overlap = 1
NOT: molecules other than hydrogen chloride

(ii) covalent [1]

(iii) <u>blue</u> litmus; [1]
(litmus) turns red [1]

(iv) pH2 [1]

(v) 2 [1]

(vi) magnesium chloride [1]
NOT: formula

Total = 17

2 (a) insoluble particles/solids/dirt trapped/caught on stones; [1]
NOT: filter reacts with insoluble impurities
NOT: impurities unqualified
Water passes through/filtered OWTTE [1]

(b) (i) kill bacteria/germs, disinfect water OWTTE [1]

(ii) neutralises acidity/water [1]
ALLOW: reacts with acids in water

(iii) calcium hydroxide [1]
NOT: formula

(iv) neutralising acid soils/neutralising acidic (industrial) waste/making bleaching powder/removing acidic gases/in Solvay process/in recovery of ammonia/making limewater/in water softening/for making plaster/for making mortar/controlling soil acidity [1]
NOT: neutralising acids unqualified
NOT: making cement

(c) **(i)** 100; [1]
°C (conditional on 100) [1]

(ii) anhydrous cobalt chloride/anhydrous copper sulphate (or correct colours); [1]
NOT: cobalt chloride/copper sulphate unqualified
Turns pink/blue (respectively) [1]

(iii) any suitable e.g. washing/cleaning/drinking/cooking [1]

(d) B [1]

(e) ethanol [1]
NOT: alcohol

(f) potassium hydroxide; hydrogen [1]
NOT: symbols

Total = 15

3 **(a)** means of measuring gas volume e.g. gas syringe/measuring cylinder
(must be graduated); [1]
flask/test tube/vessel with calcium carbonate + acid leading to syringe etc
IGNORE: lack of reference to closed system (unless drawing incorrect) [1]
record volume on gas syringe/measuring cylinder/measure how much
carbon dioxide given off [1]
at various time intervals/at a particular time [1]
OR
flask/vessel with calcium carbonate and hydrochloric acid in flask (1)
measure its mass at beginning of experiment (1)
measure mass of flask and contents during reaction (1)
at specific time(s) (1)

(b) **(i)** faster/greater/speeds up [1]

(ii) slower/less [1]

(iii) faster/greater/speeds up [1]

(c) **(i)** add aqueous sodium hydroxide; [1]
white precipitate; [1]
insoluble in excess [1]
(incorrect reagent = 0)
ALLOW: flame test - brick red

(d) **(i)** high in the reactivity series/very reactive [1]

(ii) 2 electrons in outer shell; [1]
inner shells correct as 2.8.8 [1]

Total = 13

4 **(a)** ethanol - solvent
ethene - polymer
bitumen - roads [3]

(b) ethanol [1]

(c) **(i)** C [1]

(ii) A [1]

(iii) B [1]

(iv) D [1]

(d) **(i)** (compound) containing only carbon and hydrogen [1]
NOT: it contains carbon and hydrogen

(ii) has only single bonds/ has general formula C_nH_{2n+2} [1]
NOT: it is saturated

Total = 10

5 **(a)** chlorine, argon, potassium, bromine, iodine [1]
ALLOW: symbols

(b) chlorine, potassium, argon, bromine, iodine [1]
ALLOW: symbols

(c) 2nd box down ticked [1]

(d) chlorine, bromine, iodine (all 3 needed) [1]
ALLOW: symbols

(e) **(i)** potassium/K [1]

(ii) argon/Ar [1]

(f) 1st and 4th boxes ticked (1 mark each) [2]

(g) **(i)** high (boiling point) [1]

(ii) conducts/is high [1]

(h) potassium loses an/one electron/loses outer shell [1]
chlorine gains an/one electron/outer shell becomes complete [1]
ALLOW: (for 1 mark) potassium loses two electrons + chlorine gains two electrons
ALLOW: e.g. 2.8.8.1 → 2.8.8 for first mark
Any indication of sharing electrons = 0

Total = 12

6 (a) carbon monoxide [1]

(b) iron oxide loses oxygen/it loses oxygen/oxidation number of iron decreases [1]
ALLOW: iron gains electrons
Answer must refer to the iron/iron oxide - therefore:
NOT: carbon monoxide gains oxygen
NOT: oxygen lost in the reaction
NOT: iron loses oxygen

(c) 3; 2 (one mark each) [2]

(d) (i) oxidise the impurities/oxidise Si or P or C/burn off the impurities [1]
NOT: get rid of impurities
NOT: slag formation

(ii) exothermic [1]

(iii) is/floats above the molten iron [1]

(iv) calcium oxide [1]

(v) stronger/harder/not brittle/less easily corroded ORA e.g. iron rusts [1]
NOT: less corrosive

(e) any 3 of:
high melting/boiling points;
have coloured compounds (NOT: they are coloured);
have high densities;
form complex ions;
elements/compounds are good catalysts;
form ions with different charges/variable oxidation states [3]

(f) alloys [1]

Total = 13

Grand Total = 80

June 2004

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 0620/03

CHEMISTRY
Extended

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- When the name of a chemical is demanded by the question, a **correct** formula is usually acceptable. When the formula is asked for, the name is not acceptable.

- When a word equation is required a **correct** symbol equation is usually acceptable. If an equation is requested then a word equation is not usually acceptable.

- 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 mark scheme.
- All the candidate's work must show evidence of being marked by the examiner.

1. **(a)** **(i)** portable **[1]**

(ii) oxygen **or** air **[1]**

(b) **(i)** both have four outer **or** valency electrons **[1]**
need to share four more **[1]**
or need four more to complete energy level
NOT four bonds

(ii) hard
brittle
high melting **or** boiling point
poor conductor of electricity **or** semi-conductor
any **TWO** **[2]**
NOT insoluble in water, **NOT** tough
NOT appearance

(iii) germanium **or** carbon **[1]**
NOT graphite

(c) **(i)** correctly balanced **[1]**

(ii) lost oxygen **[1]**
or decrease in oxidation number
NOT accepts electrons unless valid explanation

(iii) 4 oxygen atoms around 1 silicon atom **[1]**
2 silicon atoms around 1 oxygen **[1]**
tetrahedral **or** diagram that looks tetrahedral **[1]**
If some wrong chemistry, such as ionic MAX
2/3

TOTAL = [12]

2. **(a)** **(i)** USA **or** Texas **or** Poland **or** Mexico **or** Japan **or** Ethiopia
Australia **or** Sicily **[1]**
accept other sources of sulphur eg petroleum
or natural gas **or** metal sulphides **or** volcanoes
NOT coal, **NOT** underground

(ii) Preserving food **or** bleaching **or** sterilising **or**
disinfecting **or** making paper **or** bleaching wood pulp
or wine **or** jam **or** fumigation **or** making paper **[1]**
NOT making wood pulp

(iii) burnt/roast in oxygen **or** air **[1]**

(iv) vanadium(V) oxide **or** vanadium oxide **or** platinum **[1]**
ignore oxidation state of vanadium

(v) Increase temperature (increases rate) but reduces yield **[1]**
catalyst only increases rate **or** a catalyst does not
influence position of equilibrium **[1]**
NOT a definition of a catalyst

(vi) sulphur trioxide + sulphuric acid = oleum **[1]**
correct symbol equation acceptable

(vii) $H_2S_2O_7 + H_2O = 2H_2SO_4$ **[1]**

(b) **(i)** potassium **[1]**

(ii) ammonium sulphate **[1]**

(iii) $Ca_3(PO_4)_2$ **[1]**

$Ca(H_2PO_4)_2$ **[1]**

(iv) only acceptable responses are:
accepts a proton **[2]**
accepts H^+ **[1]** only

TOTAL = [14]

3. **(a)** dissolved **or** solution in water **[1]**
NOT aqueous **NOT** soluble in water
l liquid and g gas **[1]**

(b) 6 electrons in bond between two nitrogen atoms **[1]**
2 electrons on each nitrogen **[1]**
ignore any coding of electrons with dots **or** crosses

(c) **(i)** decreases **or** reaction stops **or** rate becomes zero **[1]**

(ii) concentration **or** number of effective collisions **[1]**
decreases **[1]**
used up **or** less chemical **or** less collisions etc **[1]** only

(iii) greater initial slope **[1]**
same final point **[1]**
as long as new curve touches the original curve near the top allocate the mark

(iv) greater surface area **[1]**

TOTAL = [10]

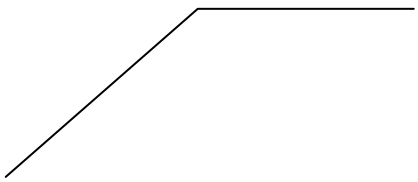
4 **(a)** **(i)** Named soluble zinc salt **[1]**
corresponding sodium salt **[1]**
If hydroxide **or** oxide then 0/2

(ii) Correct equation **[2]**
not balanced **[1]** only

(iii) Correct equation **[2]**

(b) **(i)** $Fe^{3+} + 3OH^- = Fe(OH)_3$ **[1]**

(ii) Max at $8cm^3$ **[1]**
Same shape of graph



Just the above shape, the height of the precipitate and the volume of sodium hydroxide are irrelevant **[1]**

(iii) Maximum then height of precipitate decreases **or** graph slopes down to x axis **or** comes to zero **[1]**

hydroxide dissolves in excess **or** it is amphoteric **[1]**

TOTAL = [11]

5. **(a)** Has to be three different uses.

any use that depends on malleability **or** ductility- jewellery, pipes, wires, sheets, roofing, ornaments **NOT** that it is malleable **or** ductile **[1]**

electrical wires **or** cooking utensils **or** electrodes (good) conductor **[1]**

making alloys **or** named alloy **[1]**

(**b**) **(i)** $Cu^{2+} + 2e = Cu$ **[1]**

(ii) gas is oxygen **[1]**

(copper(II) sulphate) changes to sulphuric acid **or** copper ions removed from solution **[1]**

(c) **(i)** copper atoms - electrons = copper ions accept correct symbol equation **[1]**

(ii) concentration of copper ions does not change **or** amount **or** number of copper ions does not change **[1]**

copper ions are removed and then replaced **or** copper is transferred from anode to cathode **[1]**

(iii) refining copper **or** plating (core) **or** extraction of boulder copper **[1]**

TOTAL = [10]

6. **(a)** **(i)** correct repeat unit **[1]**

COND evidence of polymer chain **[1]**

(ii) glucose **or** maltose **[1]**

(iii) addition (polymerisation) **or** no other product except polymer **[1]**

condensation (polymerisation) **or** polymer and water **[1]**

(b) **(i)** sodium hydroxide **[1]**
COND ammonia **or** alkaline gas **or** litmus red to blue **[1]**
If aluminium added wc =0

(ii) measure pH **[1]**
more than 1 and less than 7 **or**
correct colour eg orange **or** yellow **NOT** red
NOT green **[1]**
OR add magnesium **or** calcium carbonate **[1]**
weak acid reacts slowly

(c) **(i)** ethyl acrylate **[1]**
ester **or** alkene **[1]**

(ii) brown to colourless (**NOT** clear) **[1]**
correct formula for acid **NOT** ester **[1]**

TOTAL = [13]

7 **(a)** Avogadro's Number of particles
or formula mass in grams
or 6×10^{23} particles accept atoms, ions and molecules
or as many particles as there are carbon atoms in 12.00g of ^{12}Ca
ANY one **[1]**

(b) **(i)** moles of Mg = 3/24 = 0.125
moles of CH_3COOH = 12/60 = 0.200
magnesium is in excess

OR 3.0g of magnesium react with 15g of acid
only 12.0 g of acid present
magnesium is in excess **[3]**

(ii) **Mark conseq to (i) but NOT to any simple integer**
moles of H_2 = 0.1 **[1]**

(iii) **Mark conseq to (ii) but NOT to any simple integer**
Volume of hydrogen = 0.1 x 24
= 2.4 dm^3 **[2]**

(c) **(i)** moles of NaOH = 25/1000 x 0.4 = 0.01 **[1]**

(ii) **Mark conseq to (i) but NOT to any simple integer**
moles of acid = 0.01/2 = 0.005 **[1]**

(iii) **Mark conseq to (ii) max 10M**
concentration of acid = 0.005 x 1000/20 **[1]**
= 0.25 mol/dm^3 **[1]**

TOTAL = [10]

TOTAL for PAPER = [11] + [14] + [10] + [11] + [10] + [13] + [11] = [80]

June 2004

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 0620/05

CHEMISTRY
Practical

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1 **Table of results**

Experiment 1

Temperature boxes completed	**1**	
Increasing	**1**	
Comparable to supervisor	**1**	**[3]**

Experiment 2

Temperature boxes completed	**1**	
Decreasing	**1**	
Comparable to supervisor	**1**	**[3]**

(a) All points plotted correctly (-1 for each incorrect)	**4**	
Smooth line graphs	**2**	
Labelled	**1**	**[7]**

(b) **(i)** 1. Value from graph } No unit only (1)	**1**	
2. Value from graph ± 0.25 } No unit only (1)	**1**	**[2]**
(ii) 1. Exothermic	**1**	
2. Endothermic	**1**	**[2]**
(c) Fizz/bubbles/effervescence	**1**	
Solid disappears	**1**	**[2]**
(d) Carbonate	**1**	
Fizz with acid or similar	**1**	**[2]**
(e) Solid **A** – value from table/room temperature ± 3˚C	**1**	
Solid **B** – value from table/room temperature	**1**	
Reaction finished	**1**	**[3]**
Sub Total		**[24]**

2	**(a)** White	**1**	**[1]**
	(c) **(i)** White	**1**	
	Precipitate	**1**	**[2]**
	Excess – no change	**1**	**[1]**
	(ii) No precipitate/change	**1**	**[1]**
	(iii) Paper goes blue	**1**	
	Fizz/bubbles etc	**1**	
	Reference to smell	**1**	**[3]**
	(iv) pH greater than 7	**1**	**[1]**
	(v) Milky/cloudy	**1**	**[1]**
	(d) Calcium	**1**	**[1]**
	(e) Ammonia	**1**	**[1]**

(f)	Limewater	**1**	
	Carbon dioxide	**1**	**[2]**
(g)	Nitrate	**1**	
	Hydroxide	**1**	**[2]**
	Sub Total		**[16]**
	Total		**[40]**

June 2004

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 0620/06

CHEMISTRY
Alternative to Practical

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1 (a) **A** Funnel **1**
B Flask **1**
C (Teat) Pipette/dropper **1** **[3]**

(b) Increase surface area **1**
Reference to rate/efficiency/easily **1** **[2]**

(c) pH may be different/vary at different places/fair test **1** **[1]**

(d) Reference to plants/crops growth **1**
No plants **0** **[1]**

2 (a) First 4
Second 3 **1** **[1]**

(b) Water and air/oxygen necessary for rusting **1**
Statement referring to any tube e.g. no water and air in tube 1/2 **1** **[2]**

3 (a) Bulb lights up/silver liquid/metal formed/bubbles/fizz/lead x **1** **[1]**

(b) (i) Suitable material e.g. carbon/graphite/steel/Pt/Ag/An **1** **[1]**

(ii) Indication on diagram of cathode **1** **[1]**

(c) Bromine/Br_2 **1**
Anode/positive **1** **[2]**

(d) Reference to toxicity of bromine/lead/lead bromide **1** **[1]**
NOT harmful/dangerous

4 Experiment 1 Temperatures correct **2** **[2]**
(-1 any incorrect)

Time/Min	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
Temp/˚C	22	24	26	28	29	30	30	29	28	27	26

Experiment 2 Temperatures correct **2** **[2]**
(-1 any incorrect)

Time/Min	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
Temp/˚C	21	19	17	15	14	13	13	14	15	16	17

(a) Graph. Points plotted correctly **3**
(-1 each incorrect)
Smooth lines/curves **2**
Labelled **1** **[6]**

(b) (i) Temperature from graph 29.5˚C **1**
± 0.25˚C
Temperature from graph 13.5˚C **1** **[2]**

(ii) 1. Exothermic **1**
2. Endothermic **1** **[2]**

(c) Carbonate **1**
Fizz/gas with acid **1** **[2]**

	(d)	**(i)**	22˚C 21˚C	} No units only (1)	**1** **1**	
		(ii)	Reference to room temperature/reaction finished		**1**	**[3]**
5	**(a)**	**(i)**	White Precipitate		**1** **1**	**[2]**
			No change/white precipitate/insoluble in excess		**1**	**[1]**
		(ii)	No/thin precipitate/no reaction		**1**	**[1]**
	(b)		Ammonia		**1**	**[1]**
	(c)		Reference to limewater/test for carbon dioxide		**1**	**[1]**
	(d)		Nitrate Alkali/hydroxide/oxide		**1** **1**	**[2]**
6	**(a)**		Indication of copper oxide		**1**	**[1]**
	(b)		Black to red/pink/brown		**1** **1**	**[2]**
	(c)		To cool/condense Steam/water		**1** **1**	**[2]**
7	**(a)**		Anhydrous copper sulphate/cobalt chloride Goes blue/pink in water, no change for ethanol		**1** **1**	**[2]**
	(b)		Add indicator/named indicator or CO_3^{2-}/Mg Turns red/correct colour in acid, no change for sodium sulphate		**1** **1**	**[2]**
	(c)		Add silver nitrate White precipitate with hydrochloric acid, no change with nitric acid		**1** **1**	**[2]**
8			Add known mass of manganese oxide To (measured volume of) hydrogen peroxide Bubbles Test gas with glowing splint Result Filter Dry solid Reweigh and compare **(max 6)**		**1** **1** **1** **1** **1** **1** **1** **1**	**[6]**
				Total for Paper		**[60]**