

**MARK SCHEME for the June 2004 question papers**

**5070 CHEMISTRY**

<b>5070/01</b>	<b>Paper 1 (Multiple Choice), maximum raw mark 40</b>
<b>5070/02</b>	<b>Paper 2 (Theory 1), maximum raw mark 75</b>
<b>5070/03</b>	<b>Paper 3 (Practical 1), maximum raw mark 40</b>
<b>5070/04</b>	<b>Paper 4 (Theory 2 (A2 Core)), maximum raw mark 60</b>

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*.

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June 2004

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MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 5070/01

CHEMISTRY  
Paper 1 (Multiple Choice)

<b>Page 1</b>	<b>Mark Scheme</b>	<b>Syllabus</b>
	<b>CHEMISTRY – JUNE 2004</b>	<b>5070</b>

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

Total = 40

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MARK SCHEME

MAXIMUM MARK: 75

SYLLABUS/COMPONENT: 5070/02

CHEMISTRY  
Paper 2 (Theory 1)

## KEY

a semi colon ;	indicates a separation of marking points
an oblique line /	indicates alternative wording or acceptable alternative
R	means reject
A	means accept
AW	means 'alternative wording'
underlined with a <u>straight line</u>	accept this word only, no alternative word is acceptable
D	represents quality mark(s) awarded for diagrams, as indicated on the Mark Scheme
L	represents mark(s) awarded for labels on diagrams, as indicated on the Mark Scheme
Q	represents quality of expression and is used for marks awarded on free-response questions

Page 1	Mark Scheme	Syllabus
	CHEMISTRY – JUNE 2004	5070

**Section A** Maximum 45 marks

**A.1** four names at {1} each penalise correct formulae once only

(a) methane

(b) potassium nitrate

(c) potassium nitrate *or* lead(II) nitrate allow just lead nitrate

(d) phosphorus oxide *or* sulphur dioxide

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total [4]

Page 2	Mark Scheme	Syllabus
	CHEMISTRY – JUNE 2004	5070

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**A.2**

- (a) first line K 39 p =19, e = 19, n = 20 {1}  
 second line K 40 p =19, e = 19, n = 21 {1}

{2}

(b) any **two** from:

floats melts silvery ball runs around lilac flame

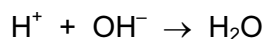
{2}

(c)

- (i) 0.195/39 = 0.005 mol K hence {1}  
 mol OH<sup>-</sup> = 0.005 {1}

- (ii) mol H<sup>+</sup> = 0.010 {1}

- (iii) ionic equation {1}



ignore any state symbols

- (iv) pH is 1 to 4 {1}  
 because an excess of HCl present {1}  
 or an extra 0.005 mol acid present {4} on Q. paper, but {5}

- (d) potassium ion has 2. 8. 8 and +1 charge {1}  
 oxide ion has 2. 8 and - 2 charge {1}

{2}

---

total [12]

---

**A.3**

(a) marks only for the reasons for the choice of poly(propene)  
if any other polymer chosen, {0} for the section

useable temp. is above 100 °C	{1}	
insoluble in oil	{1}	
		{2}

.....

(b) polythene used for cling film plastic bags etc. {1}

{1}

.....

(c) any **two** problems from

non-biodegradable litter	filling landfill sites	
burning gives toxic gases		
		{2}

.....

(d) structure of poly(propene)

correct repeat unit	{1}	
shows continuation	{1}	
		{2}

.....

(e)

(i) ester linkage {1}

(ii) fats lipids {1}

{2}

.....

(f) nylon structure {1}

allow protein or nylon 6

{1}

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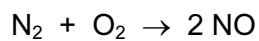
total [10]



**A.4**

**(a)**

**(i)** equation {1}



**(ii)** more collisions per unit volume  
or more crowded molecules {1}

**(ii)** faster molecules {1}  
hence more frequent collisions {1}

{4}

.....  
**(b)** incomplete combustion {1}

{1}

**(c)**

**(i)** equation {1}



ignore state symbols

**(ii)** powder has a large surface area {1}  
hence faster reaction {1}

{3}

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total [8]

Page 5	Mark Scheme	Syllabus
	CHEMISTRY – JUNE 2004	5070

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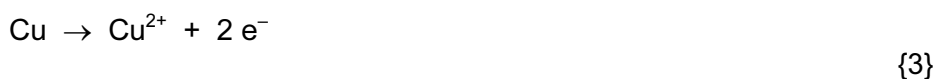
**A.5**

**(a)**

(i) copper is below hydrogen in the activity series  
 or  $\text{Cu}^{2+}$  gains electrons  
 or  $\text{Cu}^{2+}$  is reduced more easily than  $\text{H}^+$  {1}

(ii) oxidation is electron loss  
 or oxidation state of oxygen increases {1}

(iii) equation {1}



**(b)**

(i) in solid ions cannot move {1}  
 in melt ions can move {1}

(ii) cathode  $\text{Pb}^{2+} + 2 \text{e}^- \rightarrow 2 \text{Pb}$  {1}  
 anode  $2 \text{Br}^- \rightarrow \text{Br}_2$  {1}

allow {1} if equations reversed

{4}

---

total [7]

Page 6	Mark Scheme	Syllabus
	CHEMISTRY – JUNE 2004	5070

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**A.6**

(a) covalent {1}

.....

(b)  
 (i) both are giant structures *or* macromolecules {1}  
 many strong bonds to break {1}

(ii) graphite has fewer strong bonds to break {1}

{3}

.....

(c) graphite conducts, diamond does not {1}  
 delocalised electrons in graphite {1}

{2}

.....

---

total [6]

---

Section A. score any 45 from 46

Page 7	Mark Scheme	Syllabus
	CHEMISTRY – JUNE 2004	5070

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**Section B**

**B.7**

- (a) bond formation is exothermic {1}  
bond breaking is endothermic {1}  
more energy released than absorbed {1}
- {3}
- .....

- (b) diagram shows:
- labelled reactant above labelled product. {1}  
activation energy correctly labelled {1}  
enthalpy change correctly labelled {1}
- {3}
- .....

- (c) note that units are not required  
in (ii) & (iii) some working required to score both
- (i) finish at  $35 \pm 1$  {1}
- (ii) mols of  $O_2$  is  $60/24000$  {1}  
= 0.00250 {1}
- (iii) mols of  $H_2O_2 = 2 \times 0.0025 = 0.0050$  {1}  
conc. of  $H_2O_2 = 20 \times 0.0050 = 0.10$  {1}
- {5}

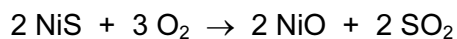
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score any [10] from [11]

**B.8**

**(a)**

(i) equation {1}



(ii) (59 + 32) kg NiS forms (32 + 32) kg SO<sub>2</sub> {1}

182 kg NiS forms  $182 \times 64 / 91 = 128$  kg SO<sub>2</sub> {1}

{3}

(b) it is covalent {1}

because low b.p. {1}

shows small forces present {1}

{3}

(c) compound and problem both needed {1}

e.g.

SO<sub>2</sub> causes acid rain *or* an effect of acid rain

CO<sub>2</sub> causes greenhouse effect *or* an effect of warming

CO is toxic

{1}

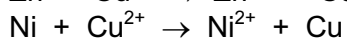
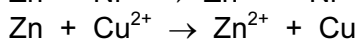
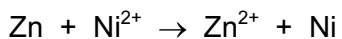
(d) used in hydrogenation of alkenes {1}

{1}

(e) Ni + Zn(NO<sub>3</sub>)<sub>2</sub> no reaction {1}

Ni + Cu(NO<sub>3</sub>)<sub>2</sub> soln changes blue to green  
and/or pink solid {1}

an equation {1}



{3}

---

score any [10] from [12]

Page 9	Mark Scheme	Syllabus
	CHEMISTRY – JUNE 2004	5070

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**B.9**

(a) equation {1}  
 $C_{12}H_{26} \rightarrow C_2H_4 + C_{10}H_{22}$  et.al. {1}

(b) ethene diagram {1} {1}

(c) mols C =  $0.72/12 = 0.06$  all three needed  
 mols H =  $0.18/1 = 0.18$  for {1}  
 mols O =  $0.96/16 = 0.06$   
 formula is  $C_6H_{18}O_6$  {1}  
 hence empirical is  $CH_3O$  {1} {3}

(d) react with steam {1}  
 using phosphoric acid {1}  
 and one of 300 ° to 600 °C; 60 to 80 atmos. {1}  
 just heat, pressure, catalyst scores {1} only {3}

(e)  
 (i) colour changes from orange to blue/green {1}  
 structure of ethanoic acid {1}  
 allow full structure  
 or condensed versions e.g.  $CH_3CO_2H$ ;  $CH_3COOH$   
 (ii) product structure {1}  
 $(CO_2H)_2$  or  $(CHO)_2$   
 or  $HOCH_2.CO_2H$  {3}

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score any [10] from [11]

Page 10	Mark Scheme	Syllabus
	CHEMISTRY – JUNE 2004	5070

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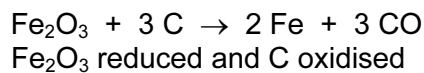
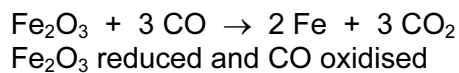
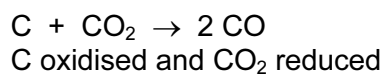
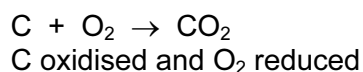
**B.10**

(a) no mark for Fe<sub>3</sub>O<sub>4</sub> alone

% Fe's are	Fe <sub>2</sub> O <sub>3</sub>	122/160 = 70.0	{1}
	Fe <sub>3</sub> O <sub>4</sub>	168/232 = 74.4	{1}
	FeCO <sub>3</sub>	56/126 = 48.2	{1}

{3}

(b) four equations plus four statements at {1} each  
allow statements using oxidation states



{4}

(c) metals have +ve ions in sea of electrons {1}  
ions can slide around {1}

{2}

(d) low carbon gives softer/more malleable steel {1}  
carbon disrupts the packing {1}

{2}

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score any [10] from [11]

June 2004

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MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 5070/03

CHEMISTRY  
Paper 3 (Practical 1)



Page 1	Mark Scheme	Syllabus
	CHEMISTRY – JUNE 2004	5070

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**1 Maximum 20 marks**

- (a) 3 marks for each reading within 1°C of the Supervisor's value.  
1 mark for each reading within 2°C of the Supervisor's value.

Any subtraction error (-1), but give the 'accuracy' mark on the corrected value.

- (b) 1 mark for plotting all the points correctly, tolerance one small square. (4)

Give one mark for two straight lines that intersect, provided that the first two points are used for one of the lines and the second two points for the second line.

Give 1 mark for each straight line which has been extrapolated so that it passes through the 'origin'.

Curves score zero

- (c) Highest temperature from the graph. This must be from the point of intersection of the two straight lines. (1)

- (d) Corresponding values for the volume of P and Q (both correct). (1)

Candidates who fail to score in (c) can score in (d), provided the values correspond to the temperature given in (c).

- (e) Concentration of sodium hydroxide in Q. (2)  
Method (1) answer (1)

Candidates who give the incorrect volumes in (d) can score consequentially.

There are no marks for the correct evaluation of an incorrect expression, answers are required correct to two significant figures.

Candidates with the correct answer but no working score (1).

Page 2	Mark Scheme	Syllabus
	CHEMISTRY – JUNE 2004	5070

### Solution S (copper sulphate + ammonia)

Test 1	Blue ppt Ppt turns brown or black Gas turns litmus blue Ammonia produced	(1) (1) (1)
	allow solid, suspension, powder but not substance, particles, deposit, residue, sediment, gelatinous, insoluble for precipitate	
Test 2	blue ppt [ppt (1) colour (1)]	(2)
	soluble in excess acid	(1)
	blue solution	(1)
	allow colourless or pale green or blue	
Test 3	White ppt [ppt (1) colour (1)]	(2)
	Insoluble in acid	(1)
	Dark blue solution becomes paler or colourless	(1)
	Blue ppt turns to a white ppt scores (2)	
Test 4	Pale blue ppt allow any colour of ppt or even turns cloudy etc	(1)
	Soluble in excess	(1)
	Colourless or pale blue solution	(1)
Test 5	No reaction	
	White ppt	(2)
	Brown or yellow solution	(2)
	Give one mark each for ppt and brown/yellow and an additional mark for linking white to the ppt and brown/yellow to the solution	
	Solution becomes colourless or white ppt	(1)

### Conclusion

The ions are  $\text{SO}_4^{2-}$   
 requires a ppt in Test 3 which does not dissolve when acid is added  
 $\text{NH}_4^+$   
 requires ammonia named or tested for in Test 1  
 $\text{Cu}^{2+}$  Any two ions to score, (-1 for names)

All points to score up to a paper mark of 40.

June 2004

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MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 5070/04

CHEMISTRY  
Paper 4 (Theory 2 (A2 Core))

Page 1	Mark Scheme	Syllabus
	CHEMISTRY – JUNE 2004	5070

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- 1 (a) Pippette (1)  
 (b) Saftey bulb (1)  
 (c) To prevent liquid entering the mouth (1) [3]

- 2 (a) It is flammable or very reactive with oxygen or water in the air (1)  
 (b) Hydrogen (1) pops in a flame (1)  
 (c) Sodium moves around the surface, inflames, dissolves, reacts violently.  
 [Any two (2)]  
 (d) Sodium hydroxide (1)  
 (e) Blue (1)  
 (f)  $2\text{Na} + 2\text{H}_2\text{O} \longrightarrow 2\text{NaOH} + \text{H}_2$  [balanced (1)]  
 (or balanced reaction based on half quantities) [8]

- 3 (a) Syringe (1)  
 (b) Turns lime water milky (1)  
 (c) (i) 0.005 (ii) 0.01 (1) (iii) No (1)  
 reaction shows that one mole of calcium carbonate requires two moles  
 of hydrochloric acid (1).  
 (d)  $0.005 \times 24 = 0.12\text{dm}^3$  (1)  
 (e)  $0.12\text{dm}^3$  (1) Magnesium carbonate (0.0059 moles) will be in excess thus  
 volume of  $\text{CO}_2$  will be based on  $\text{HCl}$  as before (1). [9]

4 to 8 (b), (a), (c), (b), (d) 1 mark each [4]

- 9 (a) 6.96 g (1)  
 (b) colourless or green to pink or purple (1)  
 (c)
- |             |             |             |
|-------------|-------------|-------------|
| 25.9        | 48.6        | 32.4        |
| <u>0.0</u>  | <u>23.3</u> | <u>6.9</u>  |
| <u>25.9</u> | <u>25.3</u> | <u>25.5</u> |
- 1 mark for each correct row or column (3)

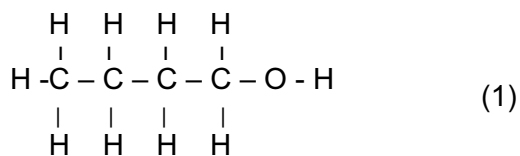
Mean value =  $25.4 \text{ cm}^3$  (1)

- (d) 0.000508 (1) (e) 0.00254 (1)  
 (f) 0.0254 (1) (g) 3.86 g (1)  
 (h) 3.10 g (1) (i) 0.172 g (1)
- [13]

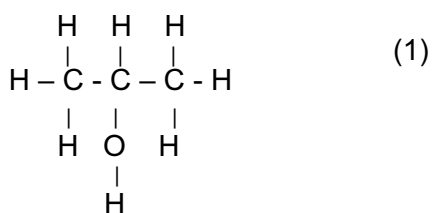
- 10 1 coloured solution (1)  
 2 blue precipitate (1) insoluble in excess (1)  
 3 blue precipitate (1) soluble in excess (1) forming a DEEP blue solution (1)  
 4 dilute nitric acid (1) aqueous silver nitrate (1) white precipitate (1)
- Formula  $\text{CuCl}_2$  (1)

Page 2	Mark Scheme	Syllabus
	CHEMISTRY – JUNE 2004	5070

- 11 (a) (i) 0.46 g (1) (ii) 36.3 and 25.8 (1) rise in T = 10.5 (1)  
 (b) (i)



- (ii) 74 (1)  
 (iii) 0.0062 moles (1)  
 (iv) 1693 kJ/mol (1)
- (c) points correctly plotted (1), smooth curve (1).  
 (d) (i) 0.062 g (1) (please read candidate's graph)  
 (ii)



- (e) To eliminate error due to heat losses,  
 to standardize the experiment or act as a control etc (1)