

**MARK SCHEME for the October/November 2009 question paper  
for the guidance of teachers**

**5124 SCIENCE (PHYSICS AND CHEMISTRY)**

**5124/03**

Paper 3 (Theory (Chemistry)), maximum raw mark 65

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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**Section A**

- 1 (a)** rusting – zinc [1]
- (b)** acid rain – sulfur dioxide [1]
- (c)** welding – acetylene (ethyne) [1]
- (d)** glass cutting – diamond [1]
- (e)** fermentation – yeast, [1]
- Accept all valid alternatives

**[Total: 5]**

- 2 (a)** four (4 × 1)
- movement:**  
gas/melt – fast movement/slow(er) movement (one)  
allow fast movement/slides over (one)  
gas/melt – bounded by container (no fixed shape)/  
bounded by melt's surface(fixed shape) (one)
- arrangement:**  
gas/melt – far apart/close(er) together (one)
- attraction:**  
gas/melt – none/strong or ionic or electrical (one) [4]
- (b)** charged particles or charged atoms or ions present or ionic compound (1)  
so particles free to move (1) and so carry current [2]
- (c)** little attraction between particles/molecules (1)  
particles/molecules easily separated by heat (1) [2]

**[Total: 8]**

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- 3 (a) final structure  
 shared pair of electrons (1),  
 eight electrons seemingly in outer shell of carbon (1),  
 two electrons seemingly in each of four hydrogen shells (1) [3]
- (b) (i) E  
 (ii) D  
 (iii) C  
 (iv) B  
 (v) A (5 × 1)  
 No description of the origination of these electrons is necessary or should be penalised. [5]
- [Total: 8]**
- 4 (a) (i) one electron in outer shell (1) so Group I,  
 (ii) sodium – eleven protons (1), twelve neutrons (1)  
 (iii) isotope – extra/fewer neutrons (1) [4]
- (b) three properties of francium, e.g. reacts with water,  
 forms positive ions, any property of metals (3 × 1) [3]  
 Accept valid alternatives including 'valency of one' and 'very reactive'.
- (c) (i) e.g.  $\text{Fr}_2\text{O}$  (1)  
 (ii) e.g.  $\text{FrCl}$  (1) [2]
- [Total: 9]**
- 5 hydrochloric acid –  $\text{HCl}$  (1) –  $\text{H}^+$  or  $\text{H}_3\text{O}^+$  (1) pH 0 – 3 (1)  
 potassium hydroxide –  $\text{KOH}$  (1) –  $\text{OH}^-$  (1) pH 10 – 14 (1)  
 salt – potassium chloride (1) [7]
- 6 (a) relative to  $1/12^{\text{th}}$  (1) a carbon-12 atom (1)  
 accept other standards  
 i.e. one hydrogen –1,  $1/16^{\text{th}}$  oxygen –16 [2]
- (b) rel. mol. mass of potassium hydroxide  $39 + 16 + 1 = 56$  [1]
- (c)  $\frac{1}{4} \times 36.5 \times 2 = 18.25$  [1]
- [Total: 4]**

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- 7 (a) epsilon [1]
- (b) alpha [1]
- (c) delta [1]
- (d) epsilon [1]
- [Total: 4]**

### Section B

- 8 (a) **carbon dioxide**  
**either** burning carbon air/oxygen (1) with equation (1)  
**or** heating limestone (one) with equation (one)  
 accept 'oxidising carbon'
- carbon monoxide**  
 carbon dioxide combines with carbon (1) with equation (1)  
 accept 'carbon burns in a limited supply of air gives carbon monoxide'
- iron**  
 iron(III) oxide is reduced by carbon monoxide (1) to form iron  
 with equation (1) [6]
- (b) **F** is barium sulfate;  
**G** is iron(II) hydroxide;  
**H** is iron(III) hydroxide;  
**I** is iron(II) sulfate  
 (4 × 1)  
 incorrect valency state for iron should be penalised once only [4]
- [Total: 10]**
- 9 (a) **particle size** – either/or bigger/smaller particles, slower/faster reaction (1)  
**temperature of acid** – either/or higher/lower temperature, faster/slower reaction (1) [2]
- (b) **either** drop magnesium into acid – collect gas (1), measure volume of gas (1), over time (1)  
 use of graph – plot volume produced against time (1)  
 counting (1) bubbles (1) over time (1) acceptable for first three marks  
 gradient at any one time gives the speed/rate of reaction (1) or compare mean rates  
**or** if answered question incorrectly by comparing other variables  
 – a max of four marks – compare something (e.g. conc., forms, length) (one), when reaction  
 stops (e.g. bubbles stop, material disappears) (one), [5]
- (c) either of above experiment  
 repeat the experiment exactly (1) but at a different temperature of acid (1) compare times (1) [3]
- [Total: 10]**

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- 10 (a)** petroleum separation – vapours heated (1) passed into the base of fractionating tower (1)  
vapours rise/condense at different levels (1)

any two products from petroleum

syllabus gives: petrol, naphtha, paraffin, diesel, lubricating oils, bitumen.

accept alternative names (2 × 1)

accept also gasoline for petrol, kerosene for paraffin, and petroleum gas

any two uses (2 × 1)

[7]

- (b)** structure ethene showing double bond (1),  
double bond opens/breaks (1),  
many, '(n)', molecules can join together (polymerise) (1).

[3]

**[Total: 10]**