This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does 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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1

(a) 46 (1) cm$^3$

(b) less (1) rate decreases as reaction proceeds (1) or similar.

(c) (i) 0.005 (1)
     (ii) 100 (1)
     (iii) 120 (1) cm$^3$

(d) (i) more powdered (1)
     (ii) increase concentration (1)

2

(a) (i) hydrogen (1)
     (ii) pops in flame (1)
     (iii) magnesium (1)
     (iv) Ag/Pb (1) reference to Reactivity series (1)

(b) (i) III/IV/V (1)
     (ii) Zn (1), reason based on relative reactivities (1)
     (iii) displacement or redox (1)
     (iv) Produces zinc oxide and carbon dioxide (1)

     $\text{ZnCO}_3 \rightarrow \text{ZnO} + \text{CO}_2$ (1)

(c) (i) carbon monoxide or dioxide (1)
     (ii) burns with a blue flame or lime water turns milky (1)
     (iii) $\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 2\text{Fe} + 3\text{CO}$ (2)

     or $2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$ (2)

3 to 6 (c), (b), (b), (c). [1 mark for each] [4]

7

(a) 2.05g (1)

(b) yellow to orange, red or pink (1)

(c) 25.8 47.0 32.3 0.0 21.8 6.9 25.8 25.2 25.4

Mean value 25.3 (1) cm$^3$

(d) 0.0024 (1)

(e) 0.0012 (1)

(f) 0.012 (1)

(g) 170.8 (1)

(h) (i) 137 (1), (ii) Barium (1) [12]
8 1 coloured (1) solution, effervescence (1) 
test: lime water, turns milky (1) carbon dioxide (1) 
2 green precipitate (1) insoluble in excess (1) 
3 green precipitate (1) insoluble in excess (1) 
\[ \text{FeCO}_3 \] (1) [9] 

9 (a) 27.8, 30.6, 33.3, 34.0 [all correct] (1) 
Temp rises: 2.8, 5.6, 8.3, 9.0, 9.0 [all correct] (1) 
(b) points correctly plotted (1) 
two straight lines intersecting correctly (2) 
(c) (i) 0.29 (1)g 
(ii) 0.65 (1)g 
(iii) reaction complete or all copper(II) sulphate reacted (1) 
(d) zinc dissolves, reacts, disappears solution becomes less blue to colourless, copper, or red deposit or solid collects on floor of beaker; [any 2] (2) 
(e) 0.56 (1)g which is 0.01 moles or similar explanation based on (c)(ii) (1) [12] 

[For answers (c)(i) and (ii) please read candidate’s graph to nearest half square.]