01. 0620_s13_ms_62 Q: 6

note: all methods can gain the first three marks but only methods that would give usable results can gain the last three marks

known / same mass / amount of metal (1)

known / same volume / amount of acid (1)

test both **A** and **B** (1)

a method of collecting results (1)

time or run side by side (1)

comparison of results (1)

max 6 [6]

02. 0620_s14_ms_62 Q: 6

crush (1)

with…pestle and mortar / hammer

OR

reason…to increase the surface area / to make smaller pieces / to increase the rate of reaction (1)
[2]

Followed by:

heat (1)

with carbon (1)

any **two** from: carbon is more reactive / displaces Pb / takes away oxygen / forms carbon dioxide / reduction (2) [4]

OR

heat (1)

with a named metal between Mg and Pb in reactivity series, e.g. Fe (1)

more reactive / displaces Pb / takes away oxygen / reduction (1)

separation of Pb and metal oxide (1) [4]
allow: heat to melt lead and run off / decant

OR

heat (1)

with carbon / CO (1)

PbO (1)

heat with carbon / CO (1) [4]

OR

heat (1)

with iron (1)

PbO (1)

separation (1) [4]

OR

dilute acid (1)
allow: any dilute acid
ignore: heating

$Pb^{2+}_{(aq)}$ / salt / solution (1)

iron (1)

displaces lead (1) [4]

OR

dilute acid (1)
allow: any dilute acid
ignore: heating

$Pb^{2+}_{(aq)}$ / salt / solution (1)

electrolysis (1)
ignore: heating

lead deposited (at cathode) (1) [4]

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03. 0620_s16_ms_63 Q: 2

(a)	initial temperature boxes completed correctly: 22, 21, 24; maximum temperature boxes completed correctly: 25, 23, 61; temperature differences completed correctly: 3, 2, 37;	**3** 1 1 1
(b)	hydrogen;	**1**
(c)	all temperature boxes completed correctly: 21, 46 and 24, 29; differences completed correctly: 25, 5;	**2** 1 1
(d)	*y*-axis scale linear and highest temperature change over half way up *y*-axis; all 5 bars at the correct height; bars clearly labelled;	**3** 1 1 1
(e)(i)	experiment 3;	**1**
(e)(ii)	magnesium is the most reactive metal;	**1**
(f)	copper formed; iron is more reactive / displacement reaction;	**2** 1 1
(g)	potassium is too reactive / dangerous;	**1**
(h)	quick / easy to use;	**1**
(i)	insulate / lag tube / use a lid; to reduce heat losses; **OR** use a pipette / burette; instead of measuring cylinder / more accurate;	**2** 1 1 1 1

04. 0620_s17_ms_61 Q: 1

(a)(i)	stirrer / glass rod	1
(a)(ii)	Spatula	1
(a)(iii)	nitric (acid)	1
(a)(iv)	bubbles / fizz / effervescence	1
(b)	the reaction is (fast) at room temperature	1
(c)	strontium carbonate	1
	solid is left behind	1
(d)	filter	1
	heat / evaporate	1
	to crystallising point / glass rod test / until saturation point	1

05. 0620_s19_ms_62 Q: 1

(a)(i)	spatula	1
(a)(ii)	Bunsen (burner)	1
(b)	solid remains / ZnO stops dissolving / reacting	1
(c)(i)	more than enough to react	1
(c)(ii)	filtration / filter	1
(d)	heat / evaporate solution	1
	to crystallising point / until saturated	1
	leave to cool	1
(e)	heating / warming not necessary (in step 1)	1

06. 0620_s20_ms_61 Q: 4

Question	Answer	Marks
	add metals to HC*l* in a beaker / flask / test-tube **fair test – max 4** • same volume HC*l* • some concentration HC*l* • same temperature acid • same mass / moles / amount metals • same surface area / form of metal **measure** • start timing when solid added • stop timing when all solid gone / reaction to stop	6

Question	Answer	Marks
	OR • start timing when solid added • stop timing when collected set volume of gas **OR** • start timing when solid added • measure volume of gas after a set time **OR** • measure temperature at start • measure temperature after reaction **OR** highest temperature reached **conclusion** • shortest time is most reactive **OR** • biggest volume of gas most reactive **OR** • biggest temperature change most reactive	

07. 0620_w12_ms_62 Q: 1

(a) flask (1)
measuring/graduated cylinder (1) [2]

(b) **(i)** does not react/unreactive/not reactive enough/below hydrogen in the reactivity series (1) [1]

(ii) magnesium/zinc/iron/aluminium (1) [1]

(c) diagram of (gas) syringe (1)
syringe labelled (1) [2]

(d) lighted splint/flame test (1)
pops (1) [2]

(a) Temperature boxes completed correctly (2), –1 for each incorrect [3]

25 31 37 42 48 48 48

Temperature rises calculated correctly (1)

0 6 12 17 23 23 23

(b) all points correctly plotted (3), –1 for any incorrect [5]

smooth straight line graphs drawn with a ruler (1)

labels (1)

(c) **(i)** value from graph (1) 0.50 – 0.52 g allow: 0.5 g ignore units [1]

(ii) value from graph (1) 8.5 – 9.0 °C [1]

allow: 9 °C ignore units

(d) 0.8 g (1) [1]

(e) zinc (1) [2]

temperature stays same when increasing amounts added/no more heat given off/no further reaction (1)

(f) no temperature changes (1) does not react owtte/(1) [2]

09. 0620_w13_ms_62 Q: 4

(c) table of results for Experiments 1, 2 and 3
initial temperature boxes completed correctly (1)
23, 22, 21
maximum temperature boxes correctly completed (1)
26, 24, 71
temperature rises correct (1)
3, 2, 50 [3]

(e) table of results for Experiments 4 and 5
initial and maximum temperature boxes completed correctly (2)
19, 21 44, 29 [2]

all temperature rises correct in tables (1)
25, 8 [1]

(f) appropriate scale for *y* axis (1)
bars inserted at correct heights (3) –1 for any incorrect
not: a line graph
labels (1) [5]

(g) **(i)** temperature rises greatest in Experiment 3 (1)

(ii) magnesium is most reactive / more reactive (1) [2]

(h) hydrogen (1) [1]

(i) **(i)** copper (1)

(ii) displacement/redox/exothermic (1) [2]
allow: oxidation/reduction

(j) solid would react slower/temperature rises would be lower/less temperature change (1)
smaller/less surface area (1) [2]
or
same temperature (1)
same mass of magnesium used (1)

(k) dangerous/too reactive/explodes/owtte (1) [1]

10. 0620_w15_ms_62 Q: 6

	Method 1: Monitoring the reaction of the metal with acid 6 from: • named acid; • same or stated volume of (same concentration of) acid; • fair test idea, i.e. same surface area / size / mass / amount metal; • measure volume of gas / count bubbles / temperature change / observe complete reaction; • suitable reference to time; • conclusion / comparison, e.g. most effervescence = most reactive; **Method 2: Displacement reaction** 6 from: • react each metal; • with named acid; • to prepare salt solution of each; • react each metal with each solution of salt; • observe if displacement occurs; • conclusion / comparison;	**6**	**I:** use of heat unless this is identified as the output variable for the experiment

11. 0620_w17_ms_61 Q: 4

	reaction with acid method max [6]: **M1** fixed volume of acid **M2** to fixed mass of metal **M3** measure volume of gas / temperature change **M4** named apparatus for the measurement **M5** after time **M6** repeat with other metals **M7** compare / conclude *displacement method* **M1** add each metal to named tin salt solution **M2** observe if deposit is formed **M3** results, e.g. Zn and Fe positive **M4** repeat with named iron salt **M5** results, e.g. Zn positive **M6** conclude	**6**

12. 0620_w17_ms_62 Q: 1

(a)	water	**1**
(b)(i)	arrow under mineral wool **AND** arrow under magnesium ribbon	**1**
(b)(ii)	boiling tube	**1**
(c)	use sandpaper / glass paper / steel wool	**1**
(d)(i)	gas syringe / measuring cylinder over a trough of water	**1**
	labelled	**1**
(d)(ii)	'pops'	**1**
(e)	**large** amount of energy released / **high** temperature reached	**1**

13. 0620_w21_ms_62 Q: 4

Question	Answer	Marks
	reduction method Any 6 from: • crush rock / break into smaller pieces / powder • using a suitable method, e.g. pestle and/or mortar, hammer • add more reactive metal / suitable gas • carbon / coke / zinc / aluminium / magnesium / CO / hydrogen specified • heat • In a suitable container (e.g. crucible, evaporating basin) • cobalt displaced / cobalt formed **electrolysis method** Any 6 from: • crush rock / break into smaller pieces / powder • using a suitable method, e.g. pestle and / or mortar, hammer • add a (dilute) acid • suitable strong acid named (e.g. HC*l*, H_2SO_4, HNO_3) • electrolysis (of solution) • specified inert material for electrodes (e.g. carbon, platinum) • cobalt obtained at the negative electrode / cathode **displacement method** Any 6 from: • crush rock / break into smaller pieces / powder • using a suitable method, e.g. pestle and / or mortar, hammer • add a (dilute) acid • suitable strong acid named (e.g. HC*l*, H_2SO_4, HNO_3) • add metal more reactive than cobalt • name of metal added specified (e.g. iron, zinc, magnesium) • Cobalt displaced / cobalt formed	6