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|    |   |
|----|---|
| 1  | D |
| 2  | B |
| 3  | C |
| 4  | D |
| 5  | D |
| 6  | B |
| 7  | C |
| 8  | A |
| 9  | A |
| 10 | B |
| 11 | D |
| 12 | D |
| 13 | D |
| 14 | B |
| 15 | C |
| 16 | B |
| 17 | C |
| 18 | D |
| 19 | C |
| 20 | B |

|          |   |  |
|----------|---|--|
| 1        | 1(a)(i)   | oxygen / $O_2$   |
|          | 1(a)(ii)  | lithium / Li   |
|          | 1(a)(iii)   | aluminium / Al   |
|          | 1(a)(iv)  | argon / Ar   |
|          | 1(a)(v)   | nickel / Ni  |
|          | 1(a)(vi)  | lithium / Li   |
|          | 1(b)  | number of electrons for Ni = 28  |
|          | number of electrons for $O^{2-}$ = 10               |  |
|          | number of neutrons Ni = 34 <b>AND</b> $O^{2-}$ = 10 |  |
|          | number of protons for $O^{2-}$ = 8                  |  |
| 2        | 2(a)(i)   | <b>A</b> placed either on the left hand lower tube (or on the one on the right directly opposite this) |
|          |   | <b>W</b> placed on both or either of the tubes at the top  |
|          | 2(a)(ii)  | the slag is above the molten iron / the iron is below the molten slag                                  |
|          | 2(b)(i)   | breakdown of a substance / breakdown of a compound   |
|          |   | using heat / using high temperature  |
|          | 2(b)(ii)  | $CO_2$   |
|          | 2(b)(iii)   | calcium oxide reacts with silicon(IV) oxide / sand   |
|          |   | to form calcium silicate / slag  |
|          | 2(c)  | apparatus correctly set up with two rods dipping into a liquid   |
|          |   | completed circuit with cell / power pack   |
|          |   | electrode(s) <b>AND</b> electrolyte correctly labelled   |
| 2(d)(i)  | graphite / platinum / (pure) iron                   |  |
| 2(d)(ii) | conducts electricity / inert                        |  |

|        |                  |   |
|--------|------------------|---|
| 3      | (a)              | <p>physical properties [max 3], e.g.:</p> <ul style="list-style-type: none"> <li>• conduct electricity (or heat)</li> <li>• shiny</li> <li>• malleable</li> <li>• ductile</li> <li>• sonorous</li> </ul> <p>chemical properties [max 2], e.g.:</p> <ul style="list-style-type: none"> <li>• react with acids</li> <li>• react with oxygen</li> </ul> <p>correct word equation (general or specific) [max 1]</p> |
|        | (b)              | nickel, zinc, magnesium, calcium<br>one consecutive pair reversed / all reversed scores [1]   |
|        | (c)(i)           | <u>atoms</u> with the same number of protons and different numbers of neutrons  |
|        | (c)(ii)          | energy (production)/ nuclear power  |
| 4      | (a)              | M1 filter   |
|        |                  | M2 wash (the residue) using water   |
|        |                  | M3 dry the residue between filter papers / in a warm place  |
|        | (c)              | M1 Universal Indicator turns blue   |
|        |                  | M2 <u>ammonia</u> / $\text{NH}_3$ (is made)   |
|        | (d)(i)           | M1 dichromate ions / particles are heavier (than silver ions)   |
|        |                  | M2 so dichromate ions diffuse / move more slowly <b>ORA</b>   |
|        |                  | M3 (where they meet they react and) silver dichromate is made   |
|        | (d)(ii)          | M1 red solid forms in less than five minutes <b>or</b> red solid forms faster / sooner  |
|        |                  | M2 particles / ions move faster   |
| (e)(i) | M1 breaking down |   |
|        | M2 when heated   |   |

|  |          |   |
|--|----------|---|
| 5  | (a)(i)   | arrow labelled <b>A</b> on or near wire going in an anti-clockwise direction  |
|  | (a)(ii)  | arrow labelled <b>B</b> in electrolyte pointing towards the cathode   |
|  | (b)(i)   | electrons are lost  |
|  | (b)(ii)  | <b>M1</b> $\text{Cu}^{2+}$ ions on left   |
|  |          | <b>M2</b> rest of equation correct and correctly balanced<br>( $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ scores [2])                     |
|  | (c)      | <b>M1</b> anode mass decreases  |
|  |          | <b>M2</b> copper lost as <u>ions</u> <b>OR</b> copper (atoms) becomes <u>ions</u> <b>OR</b><br>$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$ |
| <b>M3</b> cathode mass increases   |          |   |
| <b>M4</b> copper deposited / layer of copper forms / copper collected at cathode<br><b>OR</b> $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ |          |   |
| 6  | (a)(i)   | <b>M1</b> (relative formula mass $\text{BaCO}_3 =$ ) 197  |
|  |          | <b>M2</b> ( $10.0/197 =$ ) 0.0508<br>(0.0508 alone scores [2])  |
|  | (a)(ii)  | 1.22  |
|  | (b)      | 2.24  |
|  | (c)(i)   | 0.00219   |
|  | (c)(ii)  | <b>M1</b> moles $\text{HCl} = 2 \times 0.00219$ <b>OR</b> correct evaluation of this (= 0.00438)  |
|  |          | <b>M2</b> ( $0.00438/0.01875 =$ ) 0.234<br>(0.234 alone scores [2])   |
| 1  | 1(a)     | electrode(s)  |
|  | 1(b)     | diagram of test-tube over either electrode  |
|  |          | containing liquid   |
|  | 1(c)     | test: glowing splint<br>result: relights  |
|  | 1(d)(i)  | carbon dioxide  |
|  | 1(d)(ii) | oxygen reacted with carbon  |
|  | 1(e)     | solution became more acidic / more concentrated   |
| water was broken down / electrolysed   |          |   |