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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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1  (a)  (i)  C  [1]
    (ii)  A  [1]
    (iii) E  [1]
    (iv) D  [1]
    (v) C  [1]

(b)  (i) limestone / chalk / marble
    ignore: lime / formulae
    [1]

    (ii) 3rd box down ticked (heavier than air)  [1]

    (iii) H₂O on right
        2(HCl)
        second mark dependent on correct formula for water
        [1]

[Total: 9]
2  (a)  copper → any common use e.g. electrical wiring / pipes jewellery
    **ignore**: for alloys / for brass / for wires (unqualified)

    platinum → any common use e.g. inert electrode / jewellery
    **allow**: for catalyst (as long as not incorrect catalyst)
    aluminium → any common use e.g. food containers / car (bodies) / aircraft (bodies) / kitchen utensils / pots and pans
    **allow**: for roofing / for high voltage electrical cables
    **ignore**: for wires / for knives

(b)  (i)  poisonous / harms nervous system or brain
    **ignore**: harmful (without qualification)

   (ii)  protons → 82
         neutrons → 125

(c)  (i)  Any three of:
         sodium goes into a ball /
         gets smaller / disappears
        **allow**: dissolves **ignore**: reacts
        moves (over surface)
        bubbles / effervescence /
        **ignore**: hydrogen given off
        floats on the water (as it reacts) /
        fizzes / hissing / crackling
        **ignore**: sound
        litmus turns blue /
        **ignore**: changes colour

   (ii)  sodium hydroxide
         hydrogen

   (iii) electron
         ion
         gains
         negative

[Total: 15]
3 (a) Any two of:
   - temperature
   - mass / amount of manganese(IV) oxide / volume of manganese(IV) oxide
   - size of manganese dioxide particles
   allow: pressure
   ignore: concentration

   (b) (i) the greater the concentration the greater the speed / rate increases with concentration
   ignore: concentration increases speed / more oxygen the greater the concentration
   (ii) less hydrogen peroxide present (in B) / more hydrogen peroxide (in A)
   allow: hydrogen peroxide less concentrated (in B)
   (iii) time taken \(\rightarrow 27\) (s)
   allow: \(26\) (s)
   volume \(\rightarrow 37\) (cm\(^3\))

3 (c) magnesium \(\rightarrow\) copper \(\rightarrow\) manganese \(\rightarrow\) lead
ignore: oxide / oxidation numbers

[Total: 7]

4 (a) methane

   (b) arrangement \(\rightarrow\) random / irregularly arranged / no fixed position
   proximity \(\rightarrow\) close together / touching
   motion \(\rightarrow\) random/ sliding over each other / movement not entirely free
   allow: move slightly

   (c) (i) arrow at tube at bottom left
   ignore: direction of arrow
   (ii) group of (different) molecules / group of (different) hydrocarbons
   implication of different molecules
   with similar / (particular) range of boiling points / molecules with similar molecular masses or small range of molecular masses
   (iii) X \(\rightarrow\) naphtha
   Y \(\rightarrow\) diesel (oil)
   (iv) structure of ethane showing all atoms and all bonds
   (v) 2\(^{nd}\) box down ticked (saturated hydrocarbon)

[Total: 11]
5 (a) molecule → two or more atoms
atom → the smallest part
ion → an atom that has become

(b) (i) pH 13
(ii) 40
(iii) neutralisation
(iv) pH decreases / pH goes from higher to lower pH / suitable reference to pH values e.g. from pH 12 to pH 8
final pH below 7 / stated value below 7
ignore: gets more acidic

(c) Any six of:
bubbles (from the electrodes)
solution goes yellow(ish) / solution goes green(ish)
hydrogen at cathode
chlorine at anode
(hydrogen and chlorine gases produced at wrong electrodes = 1)
electrodes are graphite / electrodes are carbon
electrodes conducts electricity / electrons move in electrodes
hydrogen (ions) go to cathode
chloride (ions) go to the anode
smell of chlorine
electrolyte conducts electricity
ignore: hydroxide ions

[Total: 14]
6  (a) as a reducing agent / in the blast furnace / for extracting iron or zinc or other suitable metal / 
  to extract metals / in making lime

  [1] 

(b) (i) layers can slide over each other

  both ideas of layers and sliding needed

  strong bonding in all directions / covalent bonding in all directions / 
  strong bonding in macromolecules in giant structure

  both ideas of type of bonding and giant structure needed

  [1] 

(ii) for cutting / drill bits / for drills

  [1] 

(c) (i) ammonium sulfate

  ignore: water / hydrogen

  [1] 

(ii) nitrogen

  [1] 

(d) one pair of electrons in each overlap area

  [1] 

(e) 1st box ticked

  last box ticked

  [1] 
  [1] 

[Total: 9]
7 (a) (i) Any two of: have same general formula / have same pattern of formula / members differ by CH₂ group have same functional group have similar chemical properties / prepared by similar methods allow: same chemical properties not: similar properties show gradual change in physical properties / show trend in boiling points [2]

(ii) \[
\begin{array}{c}
\text{H} \\
\text{H} \\
\text{H} - \text{C} - \text{C} - \text{O} - \text{H} \\
\text{H} \\
\text{H}
\end{array}
\]
allow: OH in place of O – H [1]

(b) (i) exothermic and temperature increases / goes from 18 to 37 both: exothermic and temperature increase needed for the mark allow: exothermic because heat is given off [1]

(ii) grey / black / grey-black not: brown / purple [1]

(c) filter (off zinc); note: second mark dependent on filtration for first mark (let alcohol) evaporate / evaporate (off the alcohol) allow: warm gently (to remove some alcohol) allow: use drying agent ignore: heat unqualified / crystallise reject: residue left to dry [1]

(d) (i) ZnI₂ allow: 5ZnI₂ [1]

(ii) 2nd answer ringed (giant ionic) allow: underlined or ticked [1]

(e) 1 mark for each product zinc nitrate ammonium nitrate not: ammonia nitrate water [3]

(f) add (aqueous) sodium hydroxide (and warm) test gas evolved with red litmus paper/ universal indicator paper litmus paper/ universal indicator paper turns blue note: the 2nd and 3rd marks are dependent on the first mark being correct [1]

[Total: 15]