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IGCSE Chemistry (4335) - Foundation Tier

1. (a) water / moisture (1)
oxygen / air (1)

(b) galvanising: bucket / car body (1)
oiling: bicycle chain (1)
painting: car body / bridge (1)

(c) zinc (1)

Total 6 marks

2. (a) chromatography (1)
filtration (1)
fractional distillation (1)
distillation (1)

(b) boiling point / freezing point (1)
100°C / 0°C (1)

Total 6 marks

3. (a) nucleus (1)

(b) electron (1)

(c) electron (1)

(d) (i) 18 (1)
23 (1)
19 (1)
17 (1)

(ii) W & Z (1)
X & W or Z (1)

(iii) 2.8.1 (1)

(e) 7 (1)

Total 11 marks
4. (a) (i) ticks next to: bitumen
        gasoline
        kerosene

(ii) fractional distillation

(b) H           H
    \       /     (1)
    C = C
    /       \
    H       H

(c) orange / brown
     to colourless

(d) (i) poly(ethene)
     (ii) addition
     (iii) e.g. bags, buckets (any suitable use)

Total 11 marks

5. (a) (i) cryolite
     (ii) high melting point / conducts electricity
     (iii) oxygen
           carbon dioxide / carbon monoxide

(b) (i) → iron + carbon dioxide
     (ii) loss of oxygen / gain of electrons

(c) ticks in first and second boxes

(d) aluminium

(e) iron: cars, railway tracks, any other suitable
     aluminium: drink cans, aeroplanes, cooking foil, any other suitable

Total 11 marks

6. (a) first, third and last boxes ticked

(b) (i) green solid left / no fizzing
     (ii) to remove copper(II) carbonate
     (iii) copper(II) sulphate
           water
           NB (II) not essential

(c) (i) white
     (ii) reversible

Total 10 marks
7. (a) underground / mine / volcanoes **NOT** ores 
    crude oil **(1)**

    (b) air **NOT** oxygen 
    water **(1)**

    (c) (i) sulphur trioxide 
    (ii) range or specific temperature within 350°C - 500°C / high temperature 
    range or specific pressure within 1 - 5 atm / slightly increased (NOT high) pressure 
    \[ \text{V}_2\text{O}_5 \] / vanadium(V) oxide **(2)**

    \( \text{any two} \)

Total 7 marks

8. (a) potassium manganate(VII) / manganese(IV) oxide 
    purple / black (grey) **(1)**

    (b) denser than air **(1)**

    (c) green / yellow-green **(1)**

    (d) (damp) litmus (paper) / starch iodide paper 
    bleaches / white / black **(1)**

    (e) (i) sodium chloride 
    (ii) electrolysis **(1)**
    (iii) bleach / treating **OR** sterilising water / manufacture of HCl **(1)**

Total 9 marks

9. (a) (i) only single bonds / no more atoms can be added **(1)**
    (ii) (they contain) carbon and hydrogen **only** **(1)**

    (b) (i) \( \text{C}_n\text{H}_{2n+2} \) **(1)**
    (ii) alkanes **(1)**
    (iii) similar chemical properties 
    gradation in physical properties 
    neighbouring members differ by \( \text{CH}_2 \) **any two** **(2)**

(c) (compounds with) the same molecular formula 
    (but) different structures / structural formula **(1)**

Total 8 marks
10. (a) Na$^+$ (1)
   (b) O$_2^-$ (1)
   (c) Cl$^-$ (1)
   (d) Mg (1)
   (e) Mg$^{2+}$, Na$^+$ and O$_2^-$ (1)
   (f) MgO
      higher charges on the ions / ions have double charges (1)

Total 7 marks

11. (a) (i) enthalpy change / energy change / heat change (1)
      (ii) reaction is exothermic / heat is given out (1)

   (b) covalent (1)
      two / pair of (1)
      shared electrons (1)

   (c) $\text{H} = \text{H}$ (1)

   (d) forces between molecules (determine boiling point) (1)
      (these are) weak (1)

   (e) colourless (1)

   (f) (i) silver nitrate (1)
      (ii) white precipitate (1)
      (iii) AgNO$_3$ (on left) (1)
         AgCl and HNO$_3$ (on right) (1)

Total 14 marks

TOTAL FOR PAPER 100 MARKS
IGCSE Chemistry (4335) - Higher Tier

1. (a) (under)ground / mine / volcanoes NOT ores (1) crude oil (1)

(b) air NOT oxygen (1) water (1)

(c) (i) sulphur trioxide (1)
(ii) range or specific temperature within 350°C - 500°C / high temperature range or specific pressure within 1 - 5 atm / slightly increased (NOT high) pressure V₂O₅ / vanadium(V) oxide (2)

Total 7 marks

2. (a) potassium manganate(VII) / manganese(IV) oxide (1) purple / black (grey) (1)

(b) denser than air (1)

(c) green / yellow-green (1)

(d) (damp) litmus (paper) / starch iodide paper bleaches / white / black (1)

(e) (i) sodium chloride (1)
(ii) electrolysis (1)
(iii) bleach / treating OR sterilising water / manufacture of HCl (1)

Total 9 marks

3. (a) (i) only single bonds / no more atoms can be added (1)
(ii) (they contain) carbon and hydrogen only (1)

(b) (i) CₙH₂ₙ₊₂ (1)
(ii) alkanes (1)
(iii) similar chemical properties gradation in physical properties neighbouring members differ by CH₂ any two (2)

(c) (compounds with) the same molecular formula (1)
(but) different structures / structural formula (1)

Total 8 marks
4. (a) Na$^+$  
(b) O$^{2-}$  
(c) Cl$^-$  
(d) Mg  
(e) Mg$^{2+}$, Na$^+$ and O$^{2-}$  
(f) MgO  
higher charges on the ions / ions have double charges  

Total 7 marks

5. (a) (i) enthalpy change / energy change / heat change  
(ii) reaction is exothermic / heat is given out  
(b) covalent  
two / pair of  
shared electrons  
(c) H $\times$ H  
(d) forces between molecules (determine boiling point)  
(these are) weak  
(e) colourless  
(colourless)  
(f) (i) silver nitrate  
(ii) white precipitate  
(iii) AgNO$_3$ (on left)  
AgCl and HNO$_3$ (on right)  

Total 14 marks
6. (a) (i) solid  
(ii) 25 to 100 °C  
(b) (i) -1  
(ii) each gain one electron 
  to get full outer energy level / shell  
(c) fluorine  
(d) (i) \( \text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2 \)  
  reagents and products  
  balancing  
(ii) solution becomes red / orange / brown / yellow  
(e) \( \text{K} : \frac{16.4}{39} - 0.421; \text{Cl} : \frac{30.0}{35.5} - 0.845; \text{I} : \frac{53.6}{127} - 0.422 \)  
  simplification of ratio / dividing all by 0.421 i.e.  
  \( \text{K} = 1; \text{Cl} = 2; \text{I} = 1 \)  
  correct formula: \( \text{KCl}_2\text{I} \)  

Total 12 marks

7. (a) (i) needs lots of energy / container would melt  
(ii) cryolite has a lower melting point  
  aluminium oxide dissolves in molten cryolite  
  OR  
  mixture of aluminium oxide and cryolite has lower melting point  
(b) (i) \( \text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^- \) (or halved)  
(ii) \( \text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al} \)  
  species correct  
  balanced  
(c) \( \text{O}^{2-} / \text{oxide} \)  
  lost electrons  
(d) carbon / graphite (electrode)  
  reacts with oxygen formed  
  makes carbon dioxide / carbon monoxide  
(e) (i) regular lattice/arrangement of positive ions \( \text{NOT} \) atoms  
  delocalised/sea of electrons  
(ii) electrons mobile / free to move  

Total 14 marks
8. (a) weak acids do not dissociate/ionise fully
weak acids have higher pH / turn U.I. orange-yellow
weak acids react more slowly
\{any two\} (2)
ACCEPT reverse arguments for strong acids

(b) (i) 138
(ii) \(2.76 \div 138 = 0.02\) (moles)
(iii) volume = \(0.02 \div 0.2\) (= 0.1dm\(^3\))
\(= 100\) (cm\(^3\))
(iv) 44
(v) \(44 \times 0.02 = 0.88\) (g)
(vi) \(0.02 \times 24 = 0.48\) (dm\(^3\))

(c) (i) flame test / description of flame test
lilac
(ii) add dilute hydrochloric acid
test gas with acidified \(K_2Cr_2O_7\) / (damp) blue litmus
orange to green / goes red
NB If no test, can score last mark by stating \(SO_2\) produced
OR
add barium chloride
followed by hydrochloric acid
white precipitate which dissolves on adding hydrochloric acid

Total 14 marks

9. (a) (refinery) gases

(b) global warming

(c) (i) high temperature / alumina catalyst
(ii) fractional distillation of crude oil produces more long chain fractions than required

(d) (i) \(2640\) (kJ/mol)
if incorrect, give 1 mark for \(4 \times 412\) OR \(2 \times 496\) (2)
(ii) \(3338\) (kJ/mol)
if incorrect give 1 mark for \(2 \times 743\) OR \(4 \times 463\) (2)
(iii) \(- \, 698\) (kJ/mol) cq on (i) and (ii)

(e) (i) \(2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O\) (accept equation to produce C)
all reagents and products correct = 1
balancing = 1
(ii) CO poisonous / toxic
reduces ability of blood to carry oxygen / correct reference to haemoglobin

Total 13 marks
10. (a) (i) natural gas / oil NOT methane
(ii) \( H_2O + CH_4 \rightarrow CO + 3H_2 \)
    correct species balancing
    ALLOW correct equation producing hydrogen from cracking
(iii) iron

(b) A: oxygen / \( O_2 \)
    B: water / \( H_2O \)

(c) (i) reference to the arrow
(ii) forward and reverse reactions take place
    same rate / concentrations do not change
(iii) more / increases
(iv) less / decreases

(d) (i) acid rain
(ii) kills trees
    kills fish
    damages buildings \( \{\text{any two}\} \) (2)

Total 14 marks

11. (a) Each C bonded to 4 others
    arranged tetrahedrally
    each C held rigidly in place/strong bonds need to be broken to
    deform structure

(b) Each C bonded to 3 others
    arranged in layers of hexagons
    weak forces between layers/layers can slide over each other

(c) strong (covalent) bonds (between atoms)
    need lots of energy to overcome/break

Total 8 marks

PAPER TOTAL 120 MARKS
IGCSE Chemistry (4335) - Paper 3

1. (a) A burette (1)  
    B pipette (1)  
    C conical flask (1)  
    D (filter) funnel (1)  

(b) (i) D (1)  
    (ii) A (1)  

Total 6 marks

2. (a) they would dissolve (in the water) (1)  

(b) water rises up paper (1)  
colours separate / new colours appear / dyes move up paper (1)  

(c) (i) 3.5 cm (1)  
(ii) Q and R (1)  
(iii) use another liquid/organic solvent / use longer paper (1)  

Total 6 marks

3. (a) amount/mass/volume of organic liquid (1)  
OR temp of water (in beaker) (1)  

(b) organic liquids are flammable/would catch fire (1)  

(c) 67 (°C) (1)  
52 (s) (1)  

(d) (i) Z (1)  
(ii) X (ALLOW Z) (1)  
(iii) 50 (s) (1)  
(iv) Z (1)  
(v) X (1)  

(e) (i) (fractional) distillation (1)  
(ii) label line entering lower half of flask being heated (1)  
(iii) (water / Liebig) condenser (1)  
(iv) boiling point (1)  

Total 13 marks
4. (a) air expands on heating / contracts on cooling
   NOT just ‘fair test’
   
   (b) (i)  60 (cm$^3$)  
           45 (cm$^3$)  
   (ii)  90 of air and 72 of gas  
         18 of oxygen (ECF from air and gas volumes)
   
   (c) points plotted correctly: 5 correct = 2, 4 correct = 1
      line of best fit
   
   (d) second point circled
   
   (e) (i) higher  
      (ii) (magnesium) combines with oxygen (in air)  
      (iii) no graduation marks on jar / wider cross-section
   
   Total 12 marks

5. (a) number of moles/mass of MnO$_2$
   
   (b) D
   
   (c) (B)  40  14  
         (C)  50  25  
         (D)  50  20  
         (E)  70  40
   
   Award up to 2 marks for concentrations
   Award up to 2 marks for rates
   In each case: all four correct = 2
      three or two correct = 1
   
   (d) (i) points plotted correctly: 5 correct = 2, 4 correct = 1  
      line of best fit
   (ii) rate is (directly) proportional to concentration
   
   (e) repeat experiment(s) using:
   same concentration/volume of H$_2$O$_2$ solution
   same temperature
   same amount of solids
   same surface area of solids
   measure time to collect fixed volume of O$_2$ gas
   
   any three
   
   Total 13 marks

TOTAL FOR PAPER 50 MARKS