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Mark Scheme (Results)
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GCE

GCE O Level Chemistry (7081/02)

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A PEARSON COMPANY

SECTION A

1. (a) brown precipitate (any shade of brown) **(1)**
iron(III) hydroxide / ferric hydroxide **(1)**
$FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$ **(1)**
Or $Fe^{3+} + 3OH^- \rightarrow Fe(OH)_3$

(b) blue precipitate **(1)**
copper(II) hydroxide **(1)**
deep blue solution **(1)**
$[Cu(NH_3)_4(H_2O)_2]^{2+}$ **(1)**

(c) (green solid) turns black **(1)**
copper(II) oxide **(1)**
$CuCO_3 \rightarrow CuO + CO_2$ **(1)**

Total 10 marks

2. (a) (i) correct bond pairs shown **(1)**
other electrons correct (*dependent on the first mark*) **(1)**
correct 3-D shape (independent) **(1)**
(ii) correct bond pairs shown **(1)**
other electrons correct (*dependent on the first mark*) **(1)**
correct shape (independent) **(1)**

(b) (i) Proton **(1)**
(ii) Neutron **(1)**
(iii) number of outer electrons equals group number (also allow number of electron shells equals period number) **(1)**
Example relating to group or period as appropriate **(1)**

Total 10 marks

3. (a) M_r of A is 86 **(1)**

(b) Heat **(1)**
(catalyst of) concentrated sulphuric acid **(1)**

(c) (i) A and B **(1)**
(ii) turns limewater **(1)**
Milky **(1)**

(d) (i) A and C **(1)**
(ii) double bond or C=C (not saturated) **(1)**
(iii) addition reaction **(1)**
(iv) $CH_3CH=CHCOOH + Br_2 \rightarrow CH_3CHBrCHBrCOOH$ **(1)**
Or
$CH_3CH=CHCH_2OH + Br_2 \rightarrow CH_3CHBrCHBrCH_2OH$

Total 10 marks

4. (a) add bromine water to (aqueous) NaCl **(1)**
no reaction / solution is yellow (or orange) **(1)**
bromine cannot displace chlorine / bromine is less reactive **(1)**
bromine water + (aqueous) NaI **(1)**
red-brown solution / black precipitate **(1)**
iodine displaced / formed **(1)**
bromine more reactive than iodine **(1)**
$Br_2 + 2KI \rightarrow 2KBr + I_2$ **(1)**

(b) NaCl(aq) – white precipitate **(1)**
NaI(aq) – yellow precipitate **(1)**

Total 10 marks

5. (a) (i) decrease in number of moles / volume when methanol formed **(1)**
(ii) disadvantage: more expensive (plant) / increased maintenance costs / not explosions **(1)**

(b) (i) exothermic / heat energy evolved **(1)**
(ii) low temp. is better since reaction is exothermic **(1)**
(iii) (400^0C used because) reaction is slow at low temp/ to increase rate **(1)**
Mark dependent on correct answer to (ii)

(c) acts as a catalyst **(1)**
speeds up the reaction / increases rate of reaction **(1)**

(d) 28 g of CO $\rightarrow$ 32 g methanol *(correct molecular masses)* **(1)**
1:1 ratio recognised / mole calculation **(1)**
16 kg **(1)**

Total 10 marks

SECTION A TOTAL: 50 MARKS

SECTION B

6. (a) (i) Mix NaOH + HNO_3 / sodium hydroxide + nitric acid **(1)**
named indicator with colour change / pH meter shows 7 **(1)**
method used that avoids contamination by indicator **(1)**
Heat to reduce volume of solvent **(1)**
Leave to cool **(1)**
$NaOH + HNO_3 \rightarrow NaNO_3 + H_2O$ **(1)**

(6)

(ii) iron + chlorine **(1)**
chlorine is dry **(1)**
chlorine is passed over heated iron **(1)**
$FeCl_3$ sublimes **(1)**
suitable apparatus including collection vessel **(1)**
Equation **(1)**

(6)

(iii) copper(II) oxide + dilute sulphuric acid / $CuO + H_2SO_4$ **(1)**
add excess copper oxide and filter **(1)**
Heat **(1)**
Heat to reduce volume of solvent **(1)**
Leave to cool **(1)**
$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$ **(1)**

(6)

(b) (i) $M_r(MgSO_4.H_2O) = 138$ **(1)**
24/138 x 100 **(1)**
% Mg = 17.4 **(1)**
(If M_r taken as 122 ecf answer is 19.67 %)

(3)

(ii) dissolve in water **(1)**
add $BaCl_2$ (solution)/ $Ba(NO_3)$ (solution) **(1)**
Add hydrochloric acid / nitric acid **(1)**
white ppt. / white solid **(1)**
(If H_2SO_4 used to acidify, allow first mark only)

(4)

Total 25 marks

7. (a) similarities: fizz/bubble/effervescence/vigorous reaction
move on surface
melt
eventually dissolve
} any three **(3)**
If indicator added form alkaline solutions
difference: potassium ignites but sodium does not **(1)**
equation: formulae **(1)**
balance **(1)**
both have 1 electron in outer shell / Na = 2,8,1 & K = 2,8,8,1 **(1)**
reactivity increases down group **(1)**
atoms get bigger / more electron shells / outer electron further from nucleus **(1)**
outer electron less attracted / lost more easily **(1)**

(10)

(b) (i) no reaction **(1)**
(ii) rubidium nitrite **(1)**
oxygen **(1)**
$2RbNO_3 \rightarrow 2RbNO_2 + O_2$ **(1)**

(4)

(c) (i) $2Cl^- - 2e \rightarrow Cl_2$ **(1)**
chlorine bleaches litmus **(1)**

(ii) $2H^+ + 2e \rightarrow H_2$ **(1)**
H^+ discharged leaving OH^- (from water) **(1)**
[$2H_2O + 2e \rightarrow H_2 + 2OH^-$ can score 1st and 3nd marks]
OH^- ions turn litmus blue / alkali formed **(1)**
bubbles of gas **(1)**

(iii) sodium hydroxide **(1)**
making soap, etc. **(1)**

(8)

(d) perform flame test **(1)**
yellow – sodium **(1)**
lilac – potassium **(1)**

(3)

Total 25 marks

8. (a) fractional distillation **(1)**
vaporise sample **(1)**
Mixture / compounds separate according to their b.pts. **(1)**
low b.pt. compounds collected at top of column first / high b.pt. compounds collected at bottom of column **(1)**

(4)

(b) cracking **(1)**
high temperature (accept 400 – 900 ^{o}C) **(1)**
Long molecules / long chain hydrocarbons break down / C-C bonds break **(1)**
small <u>alkanes</u> formed **(1)**
and <u>alkenes</u> **(1)**
unsaturated molecules used for plastics manufacture / formation of petrol **(1)**
$C_6H_{14} \rightarrow C_2H_4 + C_4H_{10}$ or $2\ C_2H_4 + C_2H_6$ **(1)**

(7)

(c) ethene + steam **(1)**
heat / 250-500 ^{0}C **(1)**
pressure / 50-100 atm **(1)**
acid catalyst / phosphoric acid (not sulphuric acid) **(1)**
equation using <u>displayed</u> formulae **(1)**
one advantage: continuous, pure product, fast reaction **(1)**
one disadvantage: uses non-renewable starting material **(1)**

(7)

(d) addition polymerisation **(1)**
repeating unit of poly(ethene) **(1)**

(2)

(e) (i) moles: C = 38.7/12 H = 9.7 O = 51.6/16 **(1)**
3.225 : 9.7 : 3.225 **(1)**
1 : 3 :1 **(1)**
empirical formula = CH_3O
(ii) M_r = 3.1/0.05 = 62 **(1)**
molecular formula = $C_2H_6O_2$ **(1)**

(5)

Total 25 marks

9. (a) diamond: each carbon atom has 4 covalent bonds / tetrahedral structure **(1)**
all bonds are strong (covalent) bonds **(1)**
graphite: layer structure **(1)**
weak attractions between layers **(1)**
layers slide over each other **(1)**

(5)

(b) metals have delocalised electrons (not free) **(1)**
electrons flow **(1)**
in solid state, ions are fixed in position (in a lattice) **(1)**
in molten NaCl, ions are mobile **(1)**
ions carry the current **(1)**

(5)

(c) MgO is ionic **(1)**
oppositely charged ions / Mg^{2+} and O^{2-} **(1)**
attract each other strongly (dependent on previous mark) **(1)**
H_2O is covalent **(1)**
consists of molecules **(1)**
weak attractions between molecules / weak intermolecular forces (dependent on previous mark) **(1)**
more heat / energy needed to separate ions than molecules **(1)**

(7)

(d) argon has 8 electrons in outer shell / full outer shell / 2,8,8 **(1)**
it cannot gain / lose / share electrons **(1)**
nitrogen has a triple covalent bond (or diagram) **(1)**
this requires high energy to break **(1)**

(4)

(e) two isomers **(1)**
different structural formulae / arrangement of atoms / structures **(1)**
isomer 1 displayed / structural formula **(1)**
isomer 2 displayed / structural formula **(1)**
CH_2ClCH_2Cl
CH_3CHCl_2

(4)

Total 25 marks