MS4
£4.00

GCE MARKING SCHEME

CHEMISTRY (NEW)
AS/Advanced

SUMMER 2009

CH2

Section A

1.

Conducts electricity		Melting temperature		Bonding	
Yes	No	High	Low	Covalent	Ionic
✓		✓		✓	

[1]

2. (i) $Ba + 2\,H_2O \rightarrow Ba(OH)_2 + H_2$ [1]

(ii) Reagent: e.g. sulfuric acid [1]

Observation: white precipitate [1]

3. (i) There is no free rotation **about a double bond** / the compound has two different groups either side of the double bond [1]

(ii) potassium dichromate(VI) / $K_2Cr_2O_7$ / dichromate / $Cr_2O_7^{2-}$ [1]

(iii) oxidation / redox [1]

(iv) (relative) molecular mass / molar mass [1]

4. (i) $F_2 + 2\,e^- \rightarrow 2\,F^-$ [1]

(ii) (A) fluorine (atom) needs to gain an electron to have a full (outer) shell / fluorine has a high electronegativity [1]

Section A Total [10]

Section B

5. *(a)* (i) atom economy = $\frac{34 \times 100}{(2 \times 53.5) + 74}$ (1) = 19 (1) [2]

(ii) 45 g / 100 cm^3 ≡ 450 g dm^{-3} (1)

concentration = $\frac{450}{111}$ = 4.05 (accept 4.1) mol dm^{-3} (1) [2]

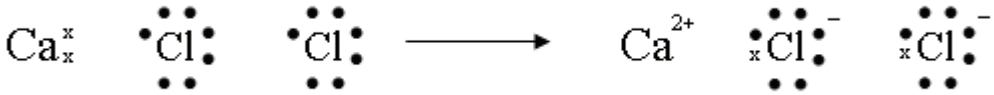
(iii) $Ca + 2HCl \rightarrow CaCl_2 + H_2$ [1]

(iv) orange-red / brick red [1]

(v) Reagent: silver nitrate / $AgNO_3$ / Ag^+ / silver ions [1]

Observation: white precipitate [1]

(vi)



left hand side correct (1) right hand side correct (1) [2]

(vii) 111g of calcium chloride removes / react with 2 ×18.0 g water (1)

∴5.55 g of calcium chloride mass removes / reacts with = $\frac{5.55 \times 2 \times 18.0}{111}$

= 1.80 (g) (1)

or in moles:

moles of calcium chloride 0.05 (1) moles of water 0.10 (1)

[2]

(viii) a covalent bond where one of the atoms (of the bond) provides both electrons [1]

Total [13]

6. *(a)* (i) ● Na^+ ○ Cl^- [1]

(ii) 6 : 6 [1]

(iii) 8 : 8 (1)

Cs^+ ion / cation is much larger than the Cl^- ion / anion (1)

[2]

(b) (i) Na^+ ions are attracted to (δ-) oxygen of water molecules (1)

Cl^- ions are attracted to (δ+) hydrogen of water molecules (1) [2]

(ii) I Mass of evaporating basin + sodium chloride solution = 140.57 g
Mass of evaporating basin = 72.00 g
∴ Mass of sodium chloride solution = 68.57 g

Mass of evaporating basin + dry sodium chloride = 90.57 g
Mass of evaporating basin = 72.00 g
∴ Mass of dry sodium chloride = 18.57 g

[1]

II 50.00 g [1]

III 2 × 18.57 = 37.14 g / 100 g water [1]

IV temperature [1]

(c) the **outer** electron of an atom is an s electron [1]

(d) $4\,Na + TiCl_4 \rightarrow Ti + 4\,NaCl$

0 +4 (-1 x 4) 0 4 (+1) 4(-1) (1)

sodium has increased its oxidation number i.e. oxidation (1) [2]

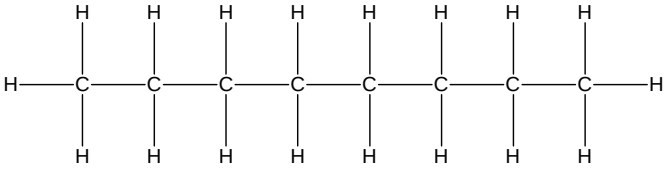
Total [13]

7. *(a)* (i) Separation of the alkanes by differences in their boiling temperatures [1]

(ii) C_9H_{20} [1]

(iii) Breaking of larger (alkane) molecules into smaller molecules (1)
which are more useful / in relative short supply (1) [2]

(iv)



[1]

(b) (i) The chlorine molecule is split by UV light (1) by homolytic fission (1)
giving two chlorine free radicals

$$Cl_2 \rightarrow 2\ Cl\bullet \quad (1)$$

In the propagation stage radicals react to produce new radicals

$$CH_3Cl + Cl\bullet \rightarrow \bullet CH_2Cl + HCl \quad (1)$$

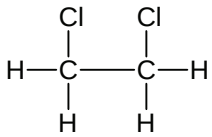
$$\bullet CH_2Cl + Cl_2 \rightarrow CH_2Cl_2 + Cl\bullet \quad (1)$$

In the termination stage two radicals combine giving dichloromethane

$$\bullet CH_2Cl + Cl\bullet \rightarrow CH_2Cl_2 \quad (1)$$ [6]

(QWC) organise information clearly and coherently, using specialist vocabulary when appropriate [1]

(ii) $C_2H_4Cl_2$ (1) displayed formula is



(accept the displayed formula of 1,1-dichloroethane) (1)

formed by the reaction together of two $\bullet CH_2Cl$ radicals (1)

[3]

Total [15]

8. *(a)* (i) I the colour changes from red/brown/orange to colourless [1]

II the name of the compound is 1,2,3-tribromobutane / 1,3-dibromobutan-2-ol / 1,2-dibromobutan-3-ol [1]

(ii) I (warm) with (aqueous) sodium hydroxide / NaOH / alkaline solution [1]

II this would give a white precipitate with aqueous silver nitrate / a source of chloride ions [1]

III the precipitate is not completely soluble in dilute aqueous ammonia / the precipitate is soluble in concentrated aqueous ammonia [1]

(b) (i) The sample would give a (broad) signal at 2500 – 3550 cm^{-1} (1)
characteristic of the O–H bond (1)
accept answers based on C–O [2]

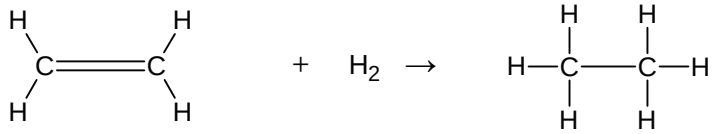
(ii) Both molecules possess van der Waals forces (1)
Both molecules possess dipole-dipole forces (1) e.g. $C^{\delta+}– Br^{\delta-}$ or $C^{\delta+}– OH^{\delta-}$ (1)
But-2-en-1-ol has hydrogen bonding and the bromo compound does not (1)
Hydrogen bonding is stronger than other intermolecular forces (1)
therefore more energy is needed to separate the molecules (1)
[6]

(QWC) *Ensure that text is legible and that spelling, punctuation and grammar are accurate so that the meaning is clear* [1]
Select and use a form and style of writing appropriate to purpose and to complex subject matter [1]

Total [15]

9. *(a)* (i) lone pair / bonding pair repulsion is
greater than bonding pair / bonding pair repulsion [1]

(ii) nitrogen and hydrogen have different electronegativities (1)
and this results in polarity / unequal electron distribution in the bond (1) [2]

(b) (i) e.g. 

equation using displayed formulae (1)

ethane named (1) [2]

(ii) e.g. spectacle frames / teeth brace [1]

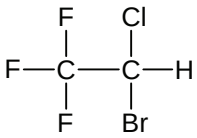
(iii) 109^{o} 28’ / 109½° / 109° [1]

(c) (i) 60 – 70 atmospheres [1]

(ii) I e.g. Al_2O_3 / porous pot / concentrated sulphuric acid /
concentrated phosphoric acid [1]

II elimination / dehydration [1]

(d) (i)



[1]

(ii) e.g. refrigerants / dry cleaning / solvents / pesticides / polymers [1]

(iii) Any TWO from:

the C – Br bond is the weakest and this has the greatest effect on the ozone layer, seen in $CHClF_2$ (0.05) and $CBrClF_2$ (10) (1)

increasing numbers of C – Cl bonds increase the RODP effect (1)

there is a marked increase in effect when going from 1 chlorine atom in a molecule to 2 chlorine atoms (1)

there is not such a marked change in effect when going from 2 chlorine atoms in a molecule to 3 chlorine atoms (1)

the C – F bond is the strongest and does not cause destruction of the ozone layer / has little effect on the ozone layer (1)

[2]

Total [14]

Section B Total [70]