GCE MARKING SCHEME

CHEMISTRY
AS/Advanced

JANUARY 2012

GCE Chemistry – CH2

SECTION A

Q.1 They show a change in properties with a change in conditions (1)

This change in properties is reversible (1) [2]

Q.2 Equation $2Na + 2H_2O \rightarrow 2NaOH + H_2$ (1)

pH Accept any value 8 to 14 inclusive / above 7 (1) [2]

Q.3 4-methylpent-2-ene [1]

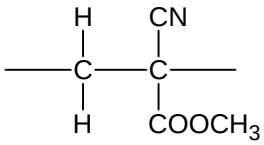
Q.4 (a) Orange to green [1]

(b) (i) C–H [1]

(ii) C [1]

(iii) 1650 to 1750 cm^{-1} C = O [1]

Q.5

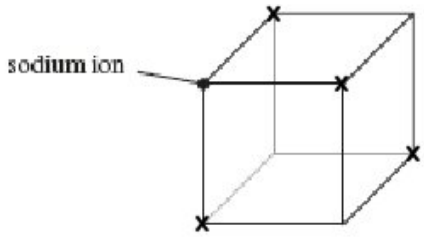


[1]

SECTION A TOTAL [10]

SECTION B

Q.6 (a) (i) [1]



Any of crosses shown

(ii) 6 (not 6,6) [1]

(b) Stir the mixture (before filtering) / heat (1)
Wash the mudstone / residue in the filter paper with water (and add the washings to the filtrate) (1) [2]

(c) (i) Add $AgNO_3$ / Ag^+ ions (assume aqueous) (1) [2]
White precipitate (1)

(ii) Add (aqueous) sodium hydroxide (solution) (1) gives (faint) white precipitate with kainite, no reaction with rock salt (1)

OR

Add barium chloride / barium nitrate / barium ions (1) gives white precipitate with kainite, no reaction with rock salt (1)

OR

Add potassium carbonate / carbonate ions (1) gives white precipitate with kainite, no reaction with rock salt (1) [2]

(d) (i) (The gaining of an electron) gives a full / stable (outer) electron shell [1]

(ii) There is less attraction between the nucleus and the (incoming) electron / oxidising power decreases down the group (increases in size is a neutral answer) [1]

(e) (i) The C–Cl bond (present in 1,1,1-trichloroethane) is **weaker** than the C–H bond (in methylcyclohexane) (1) and is broken by UV light / radicals present (that damage the ozone layer) (1) [2]

(ii) Reagent(s) Bromine (aqueous) (1)
Observation red/ brown → colourless / decolourised (1) [2]

Total [14]

Q.7 (a) (i) % of solid remaining = $\frac{2.01 \times 100}{3.24}$ = 62.0 (1)

% decomposition = 87 (1) [2]

(ii) I To avoid contamination / ensure that all Ca^{2+} ions came from the solid [1]

II So that all the calcium hydroxide that could dissolve had dissolved / to produce a saturated solution / to ensure homogeneity [1]

(iii) I 0.0225 [1]

II 0.0225 x 74.1 = 1.67 (g dm^{-3}) [1]

(iv) Calcium carbonate was removed (by filtration) [1]

(b) Brick red (1)
The 'calcium' will give a flame test colour (1) [2]

(c) $Ca^{2+} + SO_4^{2-} \rightarrow CaSO_4$ [1]

(d) Find out if the nano-particles have 'side effects' / further research to see if they work [1]

(e) 5000 tonnes of fluorapatite give 8600 tonnes of superphosphate (1)

but yield is 93% ∴ $\frac{8600 \times 93}{100}$ = 7998 / 8000 (tonnes) (1) [2]

(f) The two elements both have 2 electrons in their outer energy level / valence shell can both lose 2 electrons to become Ra^{2+} / Ca^{2+} / OWTTE [1]

Total [14]

Q.8 (a) (i) (+) 7 [1]

(ii) M_r H_2O_2 is 34.02 / 34 (1)

Concentration = $\frac{76.5 \times 10}{34.02}$ = 22.49 / 22.5 (mol dm^{-3}) (1) [2]

(iii) A covalent bond where the electrons are not shared equally between the atoms / unequal electron density (1) because of differences in electronegativity between the nitrogen and hydrogen atoms (1) [2]

(iv) A (covalent) bond where **both** electrons come from the same / one atom [1]

(v) (Nitrogen has three bonding pairs and one lone pair of electrons) and these repel each other to take up the position of minimum repulsion (1) The lone pair / bonding pair repulsion > bonding pair / bonding pair repulsion (1) [2]

(b) (i) It contains an unpaired electron [1]

(ii) I $\bullet CH_3 + Cl_2 \rightarrow CH_3Cl + Cl\bullet$ [1]

II A radical reacts to produce a new radical (that can continue the process) [1]

(iii) C_7H_{16} [1]

(iv) (Bond fission where a covalent bond breaks) and each atom receives an electron [1]

Total [13]

Q.9 (a) Hydrogen bonding occurs between (1) oxygen, nitrogen or fluorine (1) of one molecule and hydrogen, which is bonded to oxygen / nitrogen / fluorine of another molecule (1)
Alkanes do not contain an O-H, N-H or F-H bond and cannot therefore hydrogen bond to water molecules (1) [4]

QWC *Candidates should have use 'a selection and form of writing appropriate to purpose and to complexity of subject matter'* [1]

(b) (i) The (purified) petroleum is separated by heating (1) due to the different boiling temperatures of different fractions (1)

OR the mixture is vaporised (1) and then condensed according to boiling temperatures (1) (as at the oil refinery) [2]

(ii) $CuCl_2$ Cu +2 CuCl Cu +1 (1)

(reduction occurs when) the oxidation number becomes less positive (1) [2]

(c) (i) Same molecular formula but a different structural formula / structure [1]

(ii) Both of the carbon atoms of the double bond have different atoms / groups bonded to them (1)
There is no free rotation about the double bond (1) [2]

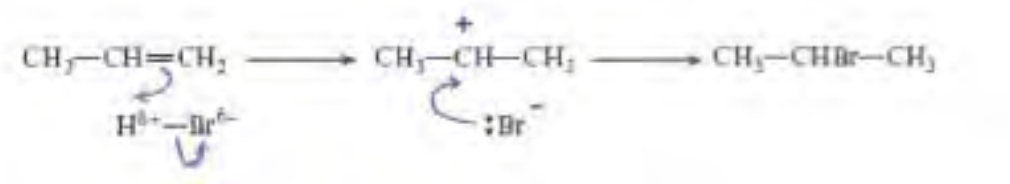
(iii) M_r of compound **A** is 146.3 / 146 (1)

Cost per mole is $\frac{146.3 \times 48 \times 100}{100 \times 73}$ = £96.20 (1)

(Accept £96.00 per mole if M_r of 146 has been used) [2]

Total [14]

Q.10 (a) (i)



curly arrows (1)
charges (1) [2]

(ii) Nucleophile hydroxide ion / OH^- / water (1)

Substitution the replacement of one functional group by another (1) [2]

(iii)

$CH_3CH_2Br + NaOH \rightarrow CH_2\ CH_2 + \mathbf{NaBr} + \mathbf{H_2O}$

(accept $\mathbf{Na^+}$ and $\mathbf{Br^-}$ in place of NaBr) [1]

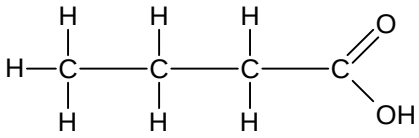
(b) M_r = 88 (1)

'M_r' R = 88 - (45) = 43 (1)

COOH

∴ R (an alkyl group) is C_3H_7

thus acid is



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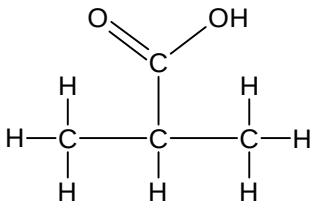

(1) [3]

(c) In graphite each carbon atom is bonded to three other carbon atoms (1) (using covalent bonding)
The other (outer) electron for each carbon atom is delocalised (1), throughout the structure and is able to move (1), conducting electricity
In iodine the two iodine atoms are bonded together (using covalent bonding) and there are no free electrons to carry the charge (1)
Mention of covalent bonding for either element (1) [5]

QWC *Legibility of text; accuracy of spelling, punctuation and grammar; clarity of meaning (1)*
Organisation of information clearly and coherently; use of specialist vocabulary where appropriate (1) [2]

Total [15]

SECTION B TOTAL [70]