M08/4/CHEMI/SP2/ENG/TZ1/XX/M+

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MARKSCHEME

May 2008

CHEMISTRY

Standard Level

Paper 2

10 pages

Subject Details: Chemistry SL Paper 2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A **[30 marks]** and **ONE** question in Section B **[20 marks]**. Maximum total = **[50 marks]**

1. A markscheme often has more marking points than the total allows. This is intentional. Do not award more than the maximum marks allowed for part of a question.

2. Each marking point has a separate line and the end is signified by means of a semicolon (;).

3. An alternative answer or wording is indicated in the markscheme by a slash (/) – either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are <u>underlined</u> are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by writing ***OWTTE*** (or words to that effect).

8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. Indicate this with **ECF** (error carried forward).

10. Only consider units at the end of a calculation. Unless directed otherwise in the mark scheme, unit errors should only be penalized once in the paper. Indicate this by writing **–1(U)** at the first point it occurs and **U** on the cover page.

11. Significant digits should only be considered in the final answer. Deduct **1 mark in the paper** for an **error of 2 or more digits** unless directed otherwise in the markscheme.

e.g. if the answer is 1.63:

2	*reject*
1.6	accept
1.63	accept
1.631	accept
1.6314	*reject*

Indicate the mark deduction by writing **–1(SD)** at the first point it occurs and **SD** on the cover page.

12. If a question specifically asks for the name of a substance, do not award a mark for a correct formula, similarly, if the formula is specifically asked for, do not award a mark for a correct name.

13. If a question asks for an equation for a reaction, a balanced symbol equation is usually expected, do not award a mark for a word equation or an unbalanced equation unless directed otherwise in the markscheme.

14. Ignore missing or incorrect state symbols in an equation unless directed otherwise in the markscheme.

SECTION A

1. (a) $CaCl_2 + 2AgNO_3 \rightarrow 2AgCl + Ca(NO_3)_2$ ***[2]***

Allow a correct ionic equation
*Award **[1]** for correct reactants and products and **[1]** for balanced equation.*

(b) $0.100 \times 0.0385\ dm^3$;
$= 3.85 \times 10^{-3}$ mol; ***[2]***

(c) 1.92×10^{-3} mol / 1.93×10^{-3} mol;

$1.92 \times 10^{-3} \times 110.98 / 111$;
= 0.214 / 0.213 (g); ***[3]***

(d) $\frac{0.214}{0.265} \times 100 / \frac{0.213}{0.265} \times 100 = 80.7 / 80.8 / 80.4\,(\%)$; ***[1]***

Allow ECF throughout question one.

2. (a) $\frac{69 \times 60.4}{100} + \frac{71 \times 39.6}{100}$;

69.8; ***[2]***

(b) (i) *Potassium ion* 2,8,8;
(ii) *Sulfide ion* 2,8,8; ***[2]***
Allow electron configuration in terms of spdf.

(c) (continuous spectrum) has all colours/wavelengths/frequencies;
(line spectrum) has only lines of specific colours/wavelengths/frequencies/has some colours missing; ***[2]***

3. (a) $(2C(s) + 2O_2(g) \rightarrow 2CO_2(g))$ $\Delta H^{\ominus} = -788$ kJ;
$(2H_2(g) + O_2(g) \rightarrow 2H_2O(l))$ $\Delta H^{\ominus} = -572$ kJ;
$(2CO_2(g) + 2H_2O(l) \rightarrow CH_3COOH(l) + 2O_2(g))$ $\Delta H^{\ominus} = +876$ kJ;

$2C(s) + 2H_2(g) + O_2(g) \rightarrow CH_3COOH(l)$ $\Delta H^{\ominus} = -484$ (kJ); ***[4]***
*Award **[4]** for correct final answer.*

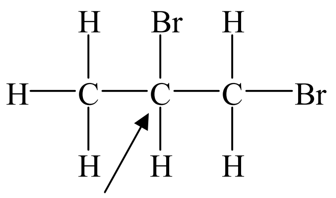
(b) negative because decrease in number of moles of gas; ***[1]***

4. (a) (buffer solution) resists changes in pH;
on addition of small amounts of acid or alkali; ***[2]***

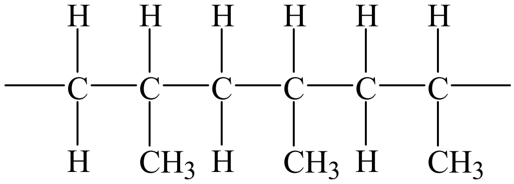
(b) (i) will act as buffer;
it consists of weak base and its salt/ contains both NH_3 and NH_4Cl/a weak base and its conjugate acid / *OWTTE*; ***[2]***

(ii) will not act as buffer because it only produces the salt $(NH_4)_2SO_4$ / absence of weak base / *OWTTE*; ***[1]***

5. (a) $C_3H_6 + Br_2 \rightarrow C_3H_6Br_2/CH_3CHBrCH_2Br$;
(orange/brown/red) colour (of bromine) disappears/is decolourized; ***[2]***
Do not accept "goes clear".

(b)  ;
chiral carbon atom; ***[2]***

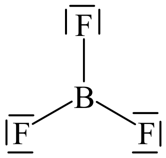
(c) addition (polymerization);

 ; ***[2]***

Allow CH_3 groups alternately above and below the spine.
Allow dotted/dashed lines at ends but not H-atoms.

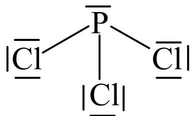
SECTION B

6. (a) (i)



;

trigonal planar;

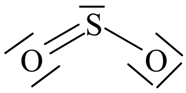


;

(trigonal) pyramidal;

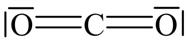
BF_3 non-polar **and** PCl_3 polar; ***[5]***

(ii)



;

angular/bent/v-shaped;



;

linear;

SO_2 polar **and** CO_2 non polar; ***[5]***

Do not allow ECF from wrong Lewis structures.
Penalize missing lone pairs on fluorine, oxygen and chlorine once only.
Penalize missing or extra lone pairs on central atom every time.

(b) (i) K more reactive / Na less reactive;
easier to remove electron from K / lower IE; ***[2]***

(ii) I^- more easily oxidised / Br^- less easily oxidized;
easier to remove electron from I^-; ***[2]***

(iii) Mg conductor/S non-conductor;
Mg's sea of/delocalised electrons free to move, whereas S's electrons are covalently bonded/not free to move; ***[2]***

(c) (MgO) basic **and** (P_4O_6 / P_4O_{10}) acidic;
(Al_2O_3) neutral;
Formulas not required but it must be clear which oxide is being referred to

$MgO + H_2O \rightarrow Mg(OH)_2$;
$P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$; ***[4]***
Accept suitable equation with $P_4O_6 / P_2O_5 / P_2O_3$.

7. (a) (i) (equilibrium shifted to the left) equilibrium concentration of NO is reduced;
more gas molecules on the right hand side than on the left; ***[2]***

(ii) (equilibrium shifted to the left) equilibrium concentration of NO is reduced;
(forward) reaction is exothermic; ***[2]***

(iii) no effect on the equilibrium concentration of NO;
catalyst increases the rate of forward and reverse reaction equally; ***[2]***

(b) $K_c = \frac{[NO]^4[H_2O]^6}{[NH_3]^4[O_2]^5}$;
mol dm^{-3}; ***[2]***

(c) increase in temperature;
K_c decreases; ***[2]***

(d) (i) rate of reaction decreases;
less frequent collisions between reactants; ***[2]***

(ii) no effect;
no change in concentration of HCl; ***[2]***

(iii) rate of reaction increases;
increase in surface area increases frequency of collisions; ***[2]***

(iv) rate of reaction increases;
kinetic energy of reacting particles increases, more frequent collisions;
greater proportion of particles have energy $\geq E_a$; ***[3]***
(i) – (iv) second mark dependent on correct first mark

(e) activation energy is lowered; ***[1]***

8. (a) (i) Mg > Zn > Ni > Cu ***[2]***
*Four metals in correct order, award **[2]**, first and last metal order correct award **[1]**.*

(ii) Mg;
Mg can reduce all other species/has a greater tendency to donate electrons; ***[2]***

(iii) Cu^{2+};
Cu^{2+} can oxidise other species/has a greater tendency to accept electrons; ***[2]***
Do not accept Cu

(b) (i) (solid state) ions in fixed position;
(molten state) ions are free to move; ***[2]***

(ii) $2Br^- \rightarrow Br_2 + 2e^-$ / $Br^- \rightarrow \frac{1}{2}Br_2 + e^-$;
Accept e instead of e^-
oxidation; ***[2]***

(iii) $Pb^{2+} + 2e^- \rightarrow Pb$;
Accept e instead of e^-
reduction; ***[2]***

*Award **[1]** for two correct equations with wrong electrodes.*

(c) (i) orange to green; ***[1]***

(ii) A is propan-1-ol/1-propanol;
Do not accept propanol

B is propanal;
C is propanoic acid; ***[3]***

(iii) esterification / condensation;
propyl ethanoate; ***[2]***

(iv) A has (stronger) hydrogen bonding;
B has (weaker) dipole-dipole attractions; ***[2]***
At least one of stronger or weaker needed to score both marks.