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GENERAL CERTIFICATE OF EDUCATION
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MARKING SCHEME

CHEMISTRY (NEW)
AS/Advanced

JANUARY 2009

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2009 examination in GCE CHEMISTRY (NEW). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

CHEMISTRY CH1 (new spec)

January 2009

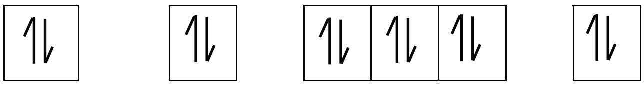
Mark Scheme

Section A

1. (a) (i) ^{27}Al [1]

(ii) 38 (minutes) [1]

(b) 1s 2s 2p 3s [1]



2. M_r CaO 56.1 (1) 0.5 × 56.1 (1) = 28.1 g [2]

3. (i) (1652 + 243) − (1585 +432) = −122 (kJ mol^{-1}) [1]

(ii) atom economy = 58 [1]

4. (i) (the electron is being removed) from an energy level further from the nucleus [1]

there is increased shielding for potassium [1]

(ii) the nuclear charge is greater for potassium [1]

Section A Total [10]

Section B

5. (a) Acidic solutions have a pH of less than 7 (1)
The lower the figure the 'higher' the degree of acidity (1) [2]

(b) (i) (When sulfur dioxide reacts with water) hydrogen ions / $H^+(aq)$ are produced [1]

(ii) The rate of the forward and reverse reactions are equal. [1]

(iii) The concentration of hydrogen ions / $[H^+]$ would increase (1)
as an increase in the concentration of the reactants moves
the position of equilibrium to the right. (1) [2]

(c) Disadvantage 1 - calcium carbonate is needed, problems of quarrying etc. (1)
Disadvantage 2 - carbon dioxide is produced, contributes to global warming. (1) [2]

(d) (i) $20 \times 24 \times 5 = 2400$ (dm^3) [1]

(ii) $137 + 32.1 + 64 = 233.1$ [1]

(iii) $0.0047 / 233.1 = 2.0(2) \times 10^{-5}$ / 0.0000202 [1]

(iv) $2.0(2) \times 10^{-5}$ / 0.0000202 [1]

(v) 0.00048(5) [1]

(vi) $2.0(2) \times 10^{-5}$ [1]

Total [14]

6. (a) (i) 4.6 to 4.8 inclusive (minutes) [1]

(ii) Measuring the intensity of iodine by colorimetry / taking samples and measuring the concentration of iodine at intervals / taking tangents at the appropriate place [1]

(iii) I. Steeper line (1) finishing at a concentration of 0.010 mol dm^{-3} (1) [2]

II. Higher temperature ≡ higher energy (1)
More reactant molecules / ions have the activation energy (1) [2]

(iv) 0.010 mol dm^{-3} (1) since the reaction is in a 1: 1 ratio and all the peroxodisulfate ions are used up (1) [2]

(v) e.g., $\frac{0.002}{0.40}$ (1) = 0.005 (1) (mol dm^{-3} min^{-1}) accept up to 1.00 on the x axis [2]
accept an appropriate gradient

(b) (i) Low(er) temperature (1) low(er) pressure (1) [2]

(ii) Uses dilute sulfuric acid / difficult to separate products, catalyst [1]

(iii) e.g., Haber process (1) iron (1) / Contact process (1) vanadium(V) oxide (1) [2]

Total [15]

7. (a) 298 K / 25 °C and 1 atmosphere pressure / atmospheric pressure [1]

(b) (i) The enthalpy change in a reaction is independent of the pathway taken [1]

(ii) −103 + (−81) = −184 (kJ) [1]

(iii) I. 79 and 81 [1]

II. 50% of each (1)
158 and 162 are the same height (1) [2]

(c) (i) 0.100 [1]

(ii) $\Delta H = -\frac{mc\Delta T}{n}$

m = 125 (1) ΔT = 10.6 (1)

$\Delta H = -\frac{125 \times 4.2 \times 10.6}{0.100} = -55650$ J (1)

$\therefore \Delta H = -55.7$ kJ mol^{-1} (1) must have negative sign [4]

(iii) Loss of heat etc. [1]

(iv) The sodium hydroxide is in excess [1]

Total [13]

8. (a) (i) The energy levels are quantised / only certain energy levels are possible (1)
therefore only certain frequencies are allowed (1) [2]

QWC The information is organised clearly and coherently, using specialist vocabulary where appropriate (1) [1]

(ii) $E = hf$ (1) $f \propto \frac{1}{\lambda}$ / $c = f\lambda$ (1)

Wavelength / nm	*Frequency* / Hz	*Energy* / J
585	higher	higher
657	lower	lower

One mark for each correct row (1) (1) [4]

(b) (i) $Ne(g) \longrightarrow Ne^{+}(g) + e^{-}$ (1) (1) [2]

One mark for correct state and one mark for the equation

(ii) Relative isotopic mass is a term that describes the number of times one atom of ^{20}Ne is as heavy (1) as one-twelfth of a ^{12}C atom (1) [2]

(iii) Relative isotopic mass only considers one isotope, but the relative atomic mass considers a weighted average of the isotopes present. [1]

(iv) 1 mole of Ne has a mass of 20 g (1)
0.890 g has a volume of 1 dm^3
$\therefore$ 20 g has a volume of $\frac{20}{0.890} = 22.5\ (dm^3)$ (1) [2]

OR

moles of neon $= \frac{0.890}{20} = 0.0445$ (1)

$\therefore$ 1 mole of neon has a volume of $1/0.0445 = 22.5\ (dm^3)$ (1)

Total [14]

9. (a) (i) Whether pure sodium hydroxide is needed / whether less pure sodium hydroxide is acceptable to the customer / whether high concentration sodium hydroxide is needed / whether lower concentration sodium hydroxide is acceptable to the customer / whether the cost of replacement diaphragms is an important economic consideration [1]

(ii) e.g., can it operate at a lower current / energy considerations
does it give a pure product, (thereby avoiding purification)
does it use or produce (other) toxic materials
do parts need replacing regularly

any two for (1) each (1) [2]

(b) (i) Measure out exactly 25.0 cm^3 (1) using a pipette / burette (1) for the first two marks then any **two** from the following:

Add this to a (250 cm^3) volumetric flask (1), dilute with (distilled) water and make up to the mark (1)
Use of a funnel (1)
Use of a dropping pipette (for making up to the mark) (1)
Now shake the mixture a number of times to ensure thorough mixing. (1) [4]

QWC Legibility of text; accuracy of spelling, punctuation and grammar, clarity of meaning. (1)
Selection of a form and style of writing appropriate to purpose and to complexity of subject matter. (1) [2]

(ii) I. 0.005(0) [1]

II. number of moles $= \dfrac{\text{concentration} \times \text{volume}}{1000}$ (1)

concentration $= \dfrac{1000 \times 0.005}{20.00} =$ 0.25(0) (mol dm^{-3}) (1) [2]

III. Original concentration = 2.5(0) (mol dm^{-3}) (1) [1]

IV. By using an indicator or named indicator eg. methyl orange / methyl red / phenolphthalein [1]

accept use of a pH meter

Total [14]

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