Formulae, Equations & Amount of Substance

Mark Scheme

Level	International A Level
Subject	Chemistry
Exam Board	Edexcel
Topic	The Core Principles of Chemistry
Sub Topic	Formulae, Equations & Amount of Substance
Booklet	Mark Scheme

Time Allowed: **84 minutes**

Score: **/70**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

Question Number	Correct Answer	Reject	Mark
1(a)	C		1
	Incorrect Answers: A – This is 80% of the starting material and not the product B - Same mass as the starting material & not the product D- This is 100% yield and not 80%		

Question Number	Correct Answer	Reject	Mark
1(b)	C		1
	Incorrect Answers: A – This is only for one mole not three B - This is for two moles not three D- Th is for five moles not three		

Question Number	Correct Answer	Reject	Mark
1(c)	C		1
	Incorrect Answers: A – This is for one water molecule not six B - This is the M_r value of water just as a percentage D- Thi is the percentage of the salt which is not water		

Question Number	Correct Answer	Reject	Mark
2(a)	A		1
	Incorrect Answers: B– Ten times too big C - 100 times too big D- ousand times too big		

Question Number	Correct Answer	Reject	Mark
2(b)	B		1
	Incorrect Answers: A – Incorrect M_r and ratio used C - The 2:1 ratio has not been used D- T 2:1 ratio has been used the wrong way round		

Question Number	Correct Answer	Reject	Mark
2(c)	A		1
	Incorrect Answers: B – There are no coloured compounds C - There is no white precipitate D- There re no coloured precipitates		

Question Number	Correct Answer	Reject	Mark
3	A		1
	Incorrect Answers: B– Hydrogen ions do not go to the anode C - Sodium would not be formed in water D- xygen ions do not go to the cathode		

Question Number	Correct Answer	Reject	Mark
4	B		**1**

Question Number	Correct Answer	Reject	Mark
5	A		**1**

Question Number	Correct Answer	Mark
6	D	**1**

Question Number	Correct Answer	Mark
7	D	**1**

Question Number	Correct Answer	Mark
8	D	**1**

Question Number	Correct Answer	Mark
9	C	**1**

Question Number	Correct Answer	Mark
10	D	**1**

Question Number	Correct Answer	Mark
11	D	**1**

Question Number	Correct Answer	Mark
12	B	**1**

Question Number	Correct Answer	Mark
13	C	**1**

Question Number	Correct Answer	Mark
14	C	**1**

Question Number	Correct Answer	Mark
15	D	**1**

Question Number	Correct Answer	Mark
16	C	**1**

Question Number	Correct Answer	Mark
17	B	**1**

Question Number	Correct Answer	Mark
18	A	**1**

Question Number	Correct Answer	Mark
19	C	**1**

Question Number	Correct Answer	Mark
20	D	**1**

Question Number	Correct Answer	Mark
21	A	**1**

Question Number	Correct Answer	Mark
22	D	**1**

Question Number	Correct Answer	Mark
23	C	**1**

Question Number	Correct Answer	Mark
24	B	**1**

Question Number	Correct Answer	Mark
25	C	**1**

Question Number	Correct Answer	Mark
26	D	**1**

Question Number	Correct Answer	Mark
27	C	**1**

Question Number	Correct Answer	Mark
28	B	**1**

Question Number	Correct Answer	Reject	Mark
29	D		1

Question Number	Correct Answer	Reject	Mark
30	C		1

Question Number	Correct Answer	Reject	Mark
31	D		1

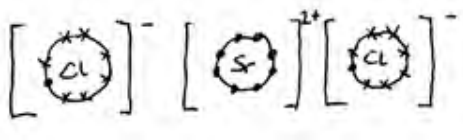
Question Number	Correct Answer	Reject	Mark
32	C		1

Question Number	Acceptable Answers	Reject	Mark
33(a)(i)	**t mark** Weighted mean mass ALLOW (Weighted) average (atomic) mass **(1)** **Second mark** (Mass) of atom(s) (of an element) ALLOW (Mass of all) the isotopes (of an element) **(1)** **Third mark** Divided by / compared with 1/12th the **mass** of (an atom of) ^{12}C / C-12 OR On a scale in which ^{12}C / C-12 = 12 (g) **(1)**	average weight atom of an isotope Mole(s) of atoms	**3**

Question Number	Acceptable Answers	Reject	Mark
33(a)(ii)	(Beam of) high energy electrons / accelerated electrons / electrons from electron gun / high speed electrons / ALLOW Electron beam OR Electrons bombard / hit / blast the (gaseous) atoms OR Electrons are fired at the (gaseous) atoms **(1)** Knock off / liberates an electron(s) / leads to loss/removal of electron(s) (from the gaseous atoms) **(1)** IGNORE References to ionising / forming (positive) ions / just an equation e.g. $M(g) \rightarrow M^+(g) + e$	Just 'electron gun' / 'electron(s)' highly charged electrons Just 'takes an electron(s)'	**2**

Question Number	Acceptable Answers	Reject	Mark
33(a)(iii)	Correct answer with or without working scores both marks ((84.0 x 0.56) + (86.0 x 9.86) + (87.0 x 7.02) +(88.0 x 82.56))/100 **(1)** = 87.7 (must be to 3 SF) **(1)** NOTE 87.71/ 87.710/87.7102 score **(1)** with or without working IGNORE g or g mol^{-1}, but wrong units, eg %, lose the second mark		**2**

Question Number	Acceptable Answers	Reject	Mark
33(b)	s (block) ALLOW S (block) IGNORE group 2 / period 5	Any number in front of the s e.g. 4s Any other group number / period number	**1**

Question Number	Acceptable Answers	Reject	Mark
33(c)	 **First mark** Correct dot and cross diagrams with 2+ charge on Sr and − charge on Cl **(1)** ALLOW no electrons or 8 electrons on outer shell of Sr ALLOW dots or crosses for electrons ALLOW diagrams without square brackets **Second mark** Ratio of 1 strontium and 2 chloride (ions) ALLOW this shown as 2 in front of a chloride ion or subscript 2 after the ion **(1)** IGNORE any inner shell electrons ALLOW max 1 for incorrect symbol(s)	covalent bonding **(0)**	**2**

Question Number	Acceptable Answers	Reject	Mark
33(d)	$SrO(s) + 2HNO_3(aq) \rightarrow Sr(NO_3)_2(aq) + H_2O(l)$ **OR** $SrO(s) + 2H^+(aq) \rightarrow Sr^{2+}(aq) + H_2O(l)$ Correct formulae and balancing ALLOW multiples **(1)** State symbols **(1)** If no other mark awarded, ALLOW Ionic equation given as $O^{2-}(s) + 2H^+(aq) \rightarrow H_2O(l)$ **(1)**	H_2 scores **(0)**	**2**

Question Number	Acceptable Answers	Reject	Mark
33(e)	SrC_2O_4 with or without working scores 3 marks Sr C O % 49.9 13.7 36.4 **(1)** A_r 87.6 12.0 16.0 divide by smaller 0.57 1.14 2.28 0.57 0.57 0.57 ratio 1 2(.004) 4/3.993 **(1)** empirical formula SrC_2O_4 **(1)** ALLOW symbols in any order ALLOW use of 87.7 instead of 87.6 ALLOW TE for MP2 and 3, if one slip in MP1 or MP2	If all A_r/%, scores **(0)** overall If all %/atomic number, scores **(0)** overall Incorrect symbol(s)	**3**

(Total for Question 33 = 15 marks)

Question Number	Acceptable Answers	Reject	Mark
34(a)	$F(g) \rightarrow F^{+}(g) + e^{(-)}$ OR $F(g) - e^{(-)} \rightarrow F^{+}(g)$ Species **(1)** State symbols IGNORE Any state symbols on electrons **(1)** 2nd mark is dependent on the first **NOTE:** $F(g) + e^{(-)} \rightarrow F^{+}(g) + 2e^{(-)}$ Use of 'Fl' **max (1)**	Electron affinity equation (0) overall Equations with $F_2(g)$ score **(0)** overall	**2**

Question Number	Acceptable Answers	Reject	Mark
34*(b)	**1 mark:** Number of protons increases / increasing nuclear charge / increasing effective nuclear charge **IGNORE** Just 'the atomic number increases' **(1)** **2nd mark:** Same shielding / same number of (occupied) shells / electron removed from the same shell / atomic radius decreases **(1)** **3rd mark:** Greater (electrostatic) attraction between nucleus / protons and (outermost) electron **(1)**	'Shielding increases' **(0)** for 2nd mark	**3**

Question Number	Acceptable Answers	Reject	Mark
34(c)*(i)	For aluminium **1st mark:** (Electron lost from) (3)**p**-subshell / (3)**p**-orbital ALLOW Correct electron configuration for Al: $1s^2 2s^2 2p^6 3s^2 3p^1$ or $[Ne]3s^2 3p^1$ or drawn as electrons-in-boxes **(1)** **NOTE** First mark must refer to aluminium **2nd mark:** at higher energy / further from the nucleus / (more) shielded (by 3s) OR Magnesium electron is at lower energy / closer to the nucleus / less shielded **(1)** **IGNORE** References to stability of $3s^2$ or full s-orbitals / full s sub-shell in Mg	Mention of **2**p, no 1st mark	**2**

Question Number	Acceptable Answers	Reject	Mark
34(c)*(ii)	For sulfur **1st mark:** (Electron lost from a) pair of electrons / an orbital with electrons (spin-) paired / a full (p) orbital **ALLOW** Mention of (3)p^4 OR Correct electron configuration for S:$1s^2 2s^2 2p^6 3s^2 3p^4$ or [Ne]$3s^2 3p^4$ or drawn as electrons-in-boxes **(1)** **2nd mark:** (increase in) **repulsion** (allows e^- to be removed more easily) **(1)** If no correct reference to Sulfur, then allow one mark for P (atom) has half-filled p sub-shell / p^3 (arrangement) is stable.		**2**

Question Number	Acceptable Answers	Reject	Mark
34(d)(i)	(Al) (Si) (P) (S) high high low low Four correct **(2)** Three correct **(1)**		**2**

Question Number	Acceptable Answers	Reject	Mark
34(d)(ii)	(Na) (Al) (Si) (P) (S) giant (giant) giant giant molecular molecular ALLOW 'giant molecular' for Si ALLOW 'simple molecular' for P and/or S Five correct **(2)** Four correct **(1)**		**2**

Question Number	Acceptable Answers	Reject	Mark
34(d)(iii)	(Na) (Al) (Si) (P) (S) high (high) high **X** low low All four must be correct **IGNORE** Any word written over **X** in the Si box		**1**

Question Number	Acceptable Answers	Reject	Mark
34(e)(i)	($\frac{2.76}{23.0}$) = 0.12(0) (mol)		**1**

Question Number	Acceptable Answers	Reject	Mark
34(e)(ii)	Moles H_2 = ½ x mol Na **(1)** Volume H_2 = 0.06(0) x 24 = 1.44 (dm^3) **(1)** ALLOW ECF from moles of Na in (e)(i) ALLOW Both marks if answer given 1440 **cm^3** Correct answer, no working scores **(2)** **NOTE:** **The following answers score (1) mark with or without working** 2.88 (dm^3) / 2880 **cm^3** 5.76 (dm^3) / 5760 **cm^3** However, check as 2.88 could score 2 as a TE of 0.24 mol from (e)(i) IGNORE SF except 1 SF		**2**

Question Number	Acceptable Answers	Reject	Mark
34(e)(iii)	**1st mark:** Moles NaOH = moles of Na **(1)** Can be implied by use of value from (e)(i) **2nd mark:** ($\frac{0.12}{0.500}$) = 0.24(0) (mol dm^{-3}) **(1)** ALLOW TE from moles of Na in (e)(i) Correct answer, no working scores **(2)** IGNORE SF except 1 SF NOTE: TE from first mark to second mark only if answer from (e)(i) has been used in some way e.g. answer to (e)(i) × 2 would not score mark 1, but could then be used to score mark 2 as a TE	No 2nd mark if give wrong units, e.g "mol/dm^{-3}" "dm^3/mol"	**2**

(Total for Question 34 = 19 marks)