Pearson

Mark Scheme (Results)

October 2025

Pearson Edexcel International Advanced
Subsidiary Level in Chemistry
WCH11/01A

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.

Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities. Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Section A

Question Number	Answer	Mark
1	**The only correct answer is C** (iron) ***A*** *is incorrect because argon is in the p-block* ***B*** *is incorrect because chlorine is in the p-block* ***D*** *is incorrect because sodium is in the s-block*	**(1)**

Question Number	Answer	Mark
2	**The only correct answer is A** (sodium fluoride) ***B*** *is incorrect because the strongest ionic bonding is between the smallest ions* ***C*** *is incorrect because the strongest ionic bonding is between the smallest ions* ***D*** *is incorrect because the strongest ionic bonding is between the smallest ions*	**(1)**

Question Number	Answer	Mark
3	**The only correct answer is A** (Ca^{2+} and S^{2-}) ***B*** *is incorrect because* K^+ *has 18 electrons and* Br^- *has 36 electrons* ***C*** *is incorrect because* Li^+ *has 2 electrons and* F^- *has 10 electrons* ***D*** *is incorrect because* Mg^{2+} *has 10 electrons and* Cl^- *has 18 electrons*	**(1)**

Question Number	Answer	Mark
4	**The only correct answer is A** (8×10^{-2}) ***B*** *is incorrect because 2000 has been divided by 40 instead of 40 by 2000* ***C*** *is incorrect because 2 kg has not been converted to 2000 g* ***D*** *is incorrect because 2 kg has not been converted to 2000g and 2 has been divided by 40*	**(1)**

Question Number	Answer	Mark
5	**The only correct answer is B** (45.8 %) ***A*** *is incorrect because the relative atomic mass of Fe on the right-hand side has not been multiplied by 2* ***C*** *is incorrect because the relative atomic mass of Fe on the right-hand side has not been multiplied by 2 and the relative molecular mass of* CO_2 *has not been multiplied by 3* ***D*** *is incorrect because the relative molecular mass of* CO_2 *has not been multiplied by 3*	**(1)**

Question Number	Answer	Mark
6	**The only correct answer is B** (2) ***A*** *is incorrect because the ratio of* $CaSO_4$ *to* H_2O *is the wrong way round* ***C*** *is incorrect because this is 3.405 x 0.900 to the nearest whole number and masses have not been converted to moles* ***D*** *is incorrect because this is 3.405/0.900 to the nearest whole number and masses have not been converted to moles*	**(1)**

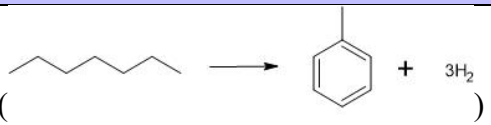
Question Number	Answer	Mark
7	**The only correct answer is D** (14) ***A*** *is incorrect because 3 is the number of quantum shells* ***B*** *is incorrect because 6 is the total number of sub-shells* ***C*** *is incorrect because 9 is the number of orbitals in the third quantum shell*	**(1)**

Question Number	Answer	Mark
8	**The only correct answer is D** (diamond) ***A*** *is incorrect because graphite contains delocalised electrons* ***B*** *is incorrect because graphene contains delocalised electrons* ***C*** *is incorrect because* C_{60} *fullerene contains delocalised electrons*	**(1)**

Question Number	Answer	Mark
9	**The only correct answer is C** (OF_2) ***A*** *is incorrect because* BF_3 *is trigonal planar and the bond dipole moments cancel* ***B*** *is incorrect because* CF_4 *is tetrahedral and the bond dipole moments cancel* ***D*** *is incorrect because* PF_5 *is trigonal pyramidal and the bond dipole moments cancel*	**(1)**

Question Number	Answer	Mark
10	**The only correct answer is A** (H_2) ***A*** *is incorrect because* H_2O *is formed in the combustion of alkane fuels* ***B*** *is incorrect because CO is formed in the incomplete combustion of alkane fuels* ***C*** *is incorrect because* CO_2 *is formed in the complete combustion of alkane fuels*	**(1)**

Question Number	Answer	Mark
11	**The only correct answer is B** (MgI_2) ***A*** *is incorrect because fluoride ions are not as easily polarised as iodide ions* ***C*** *is incorrect because barium ions are less polarising than magnesium ions, and fluoride ions are not easily polarised* ***D*** *is incorrect because barium ions are less polarising than magnesium ions*	**(1)**

Question Number	Answer	Mark
12	**The only correct answer is D** () ***A*** *is incorrect because the equation represents a correctly balanced isomerisation* ***B*** *is incorrect because the equation is correctly balanced* ***C*** *is incorrect because the equation is correctly balanced*	**(1)**

Question Number	Answer	Mark
13	**The only correct answer is C** (2,4-dimethylhexane) ***A*** *is incorrect because the longest chain of carbon atoms is six and not five* ***B*** *is incorrect because the longest chain of carbon atoms is six and not five* ***D*** *is incorrect because numbering from the left-hand side results in lower numbers for the two methyl groups*	**(1)**

Question Number	Answer	Mark
14	**The only correct answer is D** (35.0 %) ***A*** *is incorrect because this the relative atomic mass of nitrogen expressed as a percentage* ***B*** *is incorrect because this is the percentage by mass for only one nitrogen atom in the compound* ***C*** *is incorrect because this is the relative atomic mass of two nitrogen atoms expressed as a percentage*	**(1)**

Question Number	Answer	Mark
15	**The only correct answer is A** (electronic structure) ***B*** *is incorrect because this does not determine the chemical properties of an element* ***C*** *is incorrect because this does not determine the chemical properties of an element* ***D*** *is incorrect because this does not determine the chemical properties of an element*	**(1)**

Question Number	Answer	Mark
16	**The only correct answer is C** (Cr_2O_3) ***A*** *is incorrect because the moles of both Cr and O have both been rounded up to 0.10 and then the formula determined* ***B*** *is incorrect because the moles of O have been rounded up to 0.10 and then the formula determined* ***D*** *is incorrect because the ratio of chromium to oxygen is not 3:4*	**(1)**

Question Number	Answer	Mark
17	**The only correct answer is B** (C) ***A*** *is incorrect because Be has no unpaired electrons* ***C*** *is incorrect because Cl has one unpaired p electron* ***D*** *is incorrect because Ca has no unpaired electrons*	**(1)**

Question Number	Answer	Mark
18	**The only correct answer is A** () ***B*** *is incorrect because the molecular formula* C_5H_8 *cannot be simplified* ***C*** *is incorrect because the molecular formula* C_5H_{12} *cannot be simplified* ***D*** *is incorrect because the molecular formula* C_5H_{12} *cannot be simplified*	**(1)**

Question Number	Answer	Mark
19	**The only correct answer is D** (using a fume cupboard) ***A*** *is incorrect because this is not the best way to lower the risk and exposes more to it* ***B*** *is incorrect because gloves do not lower the risk of a gas* ***C*** *is incorrect because goggles do not lower the risk of a gas*	**(1)**

Question Number	Answer	Mark
20	**The only correct answer is B** (cations and delocalised electrons) ***A*** *is incorrect because this is ionic bonding* ***C*** *is incorrect because this is covalent bonding* ***D*** *is incorrect because this is dative covalent bonding*	**(1)**

TOTAL FOR SECTION A = 20 MARKS

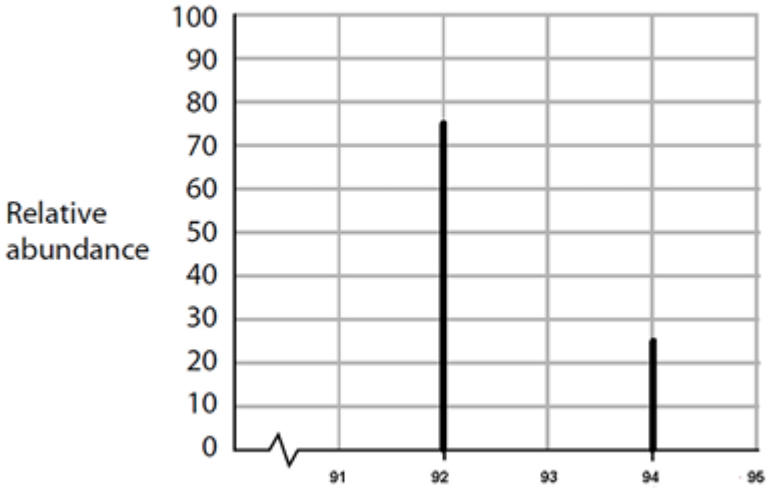
Section B

Question Number	Answer	Additional Guidance	Mark
21(a)(i)	• 17 protons **(1)** • 20 neutrons **(1)**	Allow 17p, 20n Any reference to electrons scores (1) for an answer that includes 17 protons and 20 neutrons	**(2)**

Question Number	Answer	Additional Guidance	Mark
21(a)(ii)	• $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ **(1)**	Allow use of $2px^2\ 2py^2\ 2pz^2$ etc Allow [Ne] $3s^2\ 3p^6$	**(1)**

Question Number	Answer	Additional Guidance	Mark
21(a)(iii)	• correct working **(1)** • answer to 2dp **(1)**	Example of calculation RAM = $\frac{(35 \times 75.52) + (37 \times 24.48)}{100}$ = 35.4896 RAM = 35.49 Penalise units except g mol^{-1} If no working would 35.4896 scores (1) Correct answer with no working scores (2)	**(2)**

Question Number	Answer	Additional Guidance	Mark
21(b)(i)	• diagram with one pair of electrons between the chlorine and each of the three fluorine atoms **and** remaining electrons around each fluorine atom **(1)** • two lone pairs on the central chlorine **(1)**	<u>Example of diagram</u>  Allow lone pairs shown separately Allow (1) for reversed dots and crosses Ignore overlapping circles	**(2)**

Question Number	Answer	Additional Guidance	Mark
21(b)(ii)	• peak at $m/z = 92$ **(1)** • peak at $m/z = 94$ **(1)** • peaks at 92 and 94 at 3:1 ratio approximately **(1)**	<u>Example of mass spectrum</u>  Allow any 3:1 ratio for the peaks Ignore any labels on the peaks even if incorrect Penalise each additional peak after two peaks Penalise use of histogram once only	**(3)**

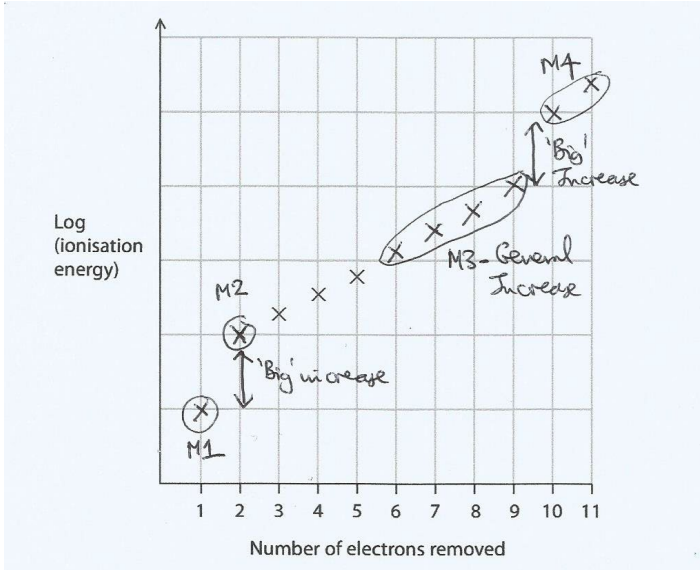
Question Number	Answer	Additional Guidance	Mark
21(c)	• calculation of mass of pentane **(1)** • calculation of moles of pentane **(1)** • calculation of moles of carbon dioxide **(1)** • calculation of volume of carbon dioxide in **cm^3** **(1)**	<u>Example of calculation</u> m = (15.0 × 0.626 =) 9.39 (g) n = (9.39 ÷ 72 =) 0.13042 (mol) n = (0.13042 × 5 =) 0.65208 (mol) V = (0.65208 × 24 × 10^3 =) 15650 (cm^3) Correct answer with no working scores (4) TE at each stage Ignore rounding throughout Ignore SF except 1SF Ignore intermediate units	**(4)**

(Total for Question 21 = 14 marks)

Question Number	Answer	Additional Guidance	Mark
22(a)	An answer that makes reference to the following points: • the energy required **(1)** • to remove one electron from each atom in a mole of atoms or to produce one mole of singly charged positive ions from one mole of atoms **(1)** • in the gaseous state **(1)**	Allow enthalpy/energy change Do not award energy given out Ignore any equations	**(3)**

Question Number	Answer	Additional Guidance	Mark
22(b)	• equation **(1)**	Example of equation $Li^{+} \rightarrow Li^{2+} + e(^{-})$ or $Li^{+} - e(^{-}) \rightarrow Li^{2+}$ Ignore state symbols	**(1)**

Question Number	Answer	Additional Guidance	Mark
22(c)	An answer that makes reference to the following point • helium only has two electrons / helium does not have a third electron to lose **(1)**	Allow It has a configuration of $1s^2$. There are no more/ further electrons to lose. Ignore just helium only having two outer electrons	**(1)**

Question Number	Answer	Additional Guidance	Mark
22(d)	An answer that makes reference to the following points: • cross for electron 1 significantly below those already present **(1)** • cross for electron 2 slightly below those already present **(1)** • crosses for electrons 6 to 9 on an approximately straight line upwards continuing from electrons 3 to 5 **(1)** • cross for electron 10 significantly above the cross for electron 9 **and** cross for electron 11 slightly above the cross for electron 10 **(1)**	**Mark independently** Ignore lines drawn between crosses If M3 lost due to electron 9 being too high then allow M4 for correct position of 10 and 11 being significantly above electron 8 <u>Example of sketch</u>  	**(4)**

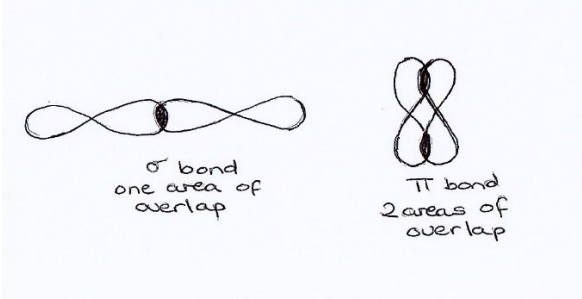
Question Number	Answer	Additional Guidance	Mark
22(e)	An explanation that makes reference to three of the following points • there is an increase in atomic radius **(1)** • (and) there is an increase in shielding/ there is an increase in electron repulsion (by inner shells of electrons) **(1)** • (resulting in) less **attraction** between the nucleus and the outer electron(s) **(1)** • despite the increasing number of protons/ nuclear charge **(1)**	Allow more shells Allow outer electron further from the nucleus Allow electrons in a higher energy level Ignore less energy to remove an electron Do not award if reason for less attraction is decreased number of protons Ignore atomic number	**(3)**

Question Number	Answer	Additional Guidance	Mark
22(f)	An explanation that makes reference to the following points: • (for sulfur) the outermost electron is paired in the **p orbital** **(1)** • so is repelled by the other electron (reducing the first ionisation energy) **(1)** or • phosphorus is higher because the electron is being removed from a singly occupied **p orbital** **(1)** • so there is no electron repulsion (resulting in a higher first ionisation energy) **(1)**	Allow electrons in boxes Ignore electron configurations, but can be evidence that it is a p electron if not stated Do not award paired p subshell/shell Allow spin pair repulsion Do not award electron pairs repel Penalise 2p once only	**(2)**

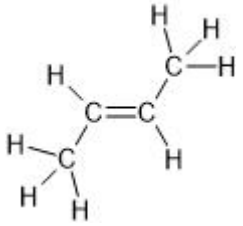
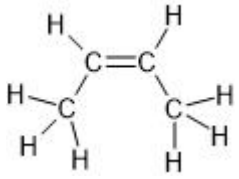
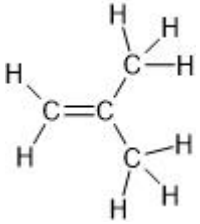
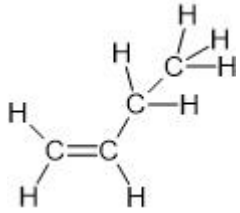
Question Number	Answer	Additional Guidance	Mark
22(g)	An answer that makes reference to the following points: (Ionisation energy value) • any value in the range (+) 520 – 700 (kJ mol^{-1}) **(1)** (Justification) • (because) for aluminium the outermost electron is in a (3)p orbital whereas it is in a (3)s orbital for magnesium **(1)** • which is further from the nucleus/ at higher energy level (and requires less energy to remove) **(1)**	Do not award negative value Accept reverse arguments Allow valence electron being removed Ignore correct electron configurations Accept more shielded/ greater repulsion (by inner shells)	**(3)**

(Total for Question 22 = 17 marks)

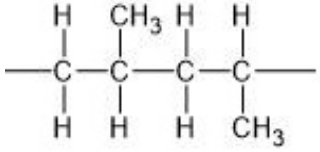
Question Number	Answer		Additional Guidance	Mark
23(a)	• conversion of temperature to K	**(1)**	Example of calculation T = (108+273 =) 381 (K) Allow addition of 273.15 for conversion	**(4)**
	• rearrangement of ideal gas equation	**(1)**	$V = nRT \div p$ or $V = (0.0200 \times 8.31 \times 381 \div 1.28 \times 10^5 =)$	
	• evaluation to give volume	**(1)**	$V = 4.9470 \times 10^{-4}$ (m^3)	
	• conversion of volume to cm^3 **and** answer to **2/3 SF**	**(1)**	$V = (4.9470 \times 10^{-4} \times 10^6 =) 494.70$ (cm^3) V = 495/ 490 / 4.95×10^2 cm^3 Correct answer with some working scores (4) TE at each stage Do not award 494 for M4 as incorrect rounding	

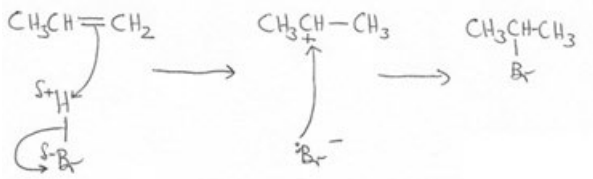
Question Number	Answer	Additional Guidance	Mark
23(b)(i)	A description that makes reference to the following points: • a sigma bond has a single area of orbital overlap **and** a pi bond has two areas of orbital overlap **(1)** • a sigma bond has head-on orbital overlap **and** a pi bond has sideways overlap **(1)**	Suitable labelled diagrams can score both marks <u>Example of diagram</u>  Unlabelled diagram showing overlap would score M1 only If no other mark awarded then give (1) for two correct statements about either sigma or pi bonds	**(2)**

Question Number	Answer	Additional Guidance	Mark
23(b)(ii)	An answer that makes reference to the following point • lack of (free) rotation/ restricted rotation about C=C **(1)**	Allow restricted rotation about the double bond Allow the double bond cannot rotate/ no rotation about the double bond Ignore reference to the groups attached to the double bond Do not award reference to molecular rotation	**(1)**

Question Number	Answer	Additional Guidance	Mark
23(b)(iii)	An answer that makes reference to the following points: • formula of E isomer • formula of Z isomer • formula of isomer with no E-Z isomerism • name of isomer All 4 bullet points scores (3) 3 bullet points scores (2) 2 bullet points scores (1)	Allow structural/skeletal/semi-displayed formulae <u>Example of formulae</u>  *E* isomer  *Z* isomer Allow (1 bullet point) for isomers drawn the wrong way round Ignore connectivity  2-methylpropene  but-1-ene Allow (2-) methylprop-1-ene Allow 2 methlypropene Penalise missing hydrogen atoms once only	**(3)**

Question Number	Answer	Additional Guidance	Mark
23(c)(i)	• formula of dibrominated product top left **(1)** • formula of diol product bottom middle **(1)** (reagents top right) • hydrogen (gas)/H_2 **and** nickel/Ni /platinum/Pt **(1)**	<u>Example of formulae</u> $CH_3CHBrCH_2Br$ $CH_3CHOHCH_2OH$ Ignore inclusion of rounded brackets Penalise horizontal connectivity of the alcohol group eg C–HO Penalise non-structural formulae once only Allow rhodium/ Rh Do not award just H	**(3)**

Question Number	Answer	Additional Guidance	Mark
23(c)(ii)	• structure with **two** repeat units of poly(propene) **(1)**	<u>Example of structure</u>  Accept methyl groups drawn atactic, isotactic, syndiotactic	**(1)**

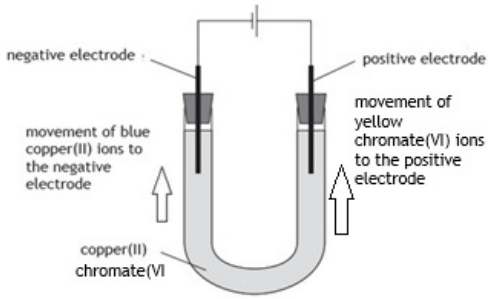
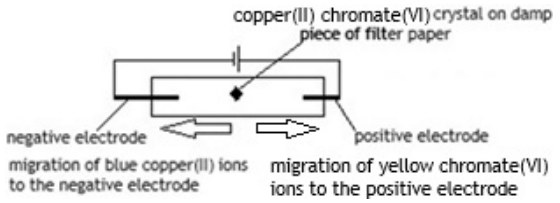
Question Number	Answer	Additional Guidance	Mark
23(d)	An answer that makes reference to the following points: • curly arrow from C=C to the (δ+)H • dipole on HBr • curly arrow from the H−Br bond to Br or just beyond • structure of carbocation • bromide ion with lone pair • curly arrow from (lone pair on) bromide ion to C+ • structure of major product	<u>Example of mechanism</u>  All 7 bullet points scores (4) 5/6 bullet points scores (3) 3/4 bullet points scores (2) 2 bullet points scores (1) Allow primary or secondary carbocation Allow Br^- with 4 lone pairs Use of Br_2 would lose bullet points 1 and 7 Incorrect structure of propene loses 1 bullet point Penalise single headed arrows/ fish hooks only once	**(4)**

(Total for Question 23 = 18 marks)

Question Number	Answer	Additional Guidance	Mark
24(a)(i)	• molar mass of iron(II) sulfate **(1)** • moles of iron(II) sulfate **(1)** • maximum mass of Mohr's salt **(1)** • mass with 78.2 % yield **(1)**	<u>Example of calculation</u> M_r = 277.9 n = (6.95 ÷ 277.9 =) 0.02501 (mol) m = (0.02501 × 392 =) 9.8035 (g) m = (9.8035 × 78.2 ÷ 100 =) 7.6664 (g) if 278 is used with no rounding the final answer is 7.6636g Correct answer with no working scores 4 Ignore SF except 1SF Allow TE throughout Allow values expressed as fractions	**(4)**

Question Number	Answer	Additional Guidance	Mark
24(a)(ii)	• moles of cations present in two moles of Mohr's salt **(1)** • number of cations present in two moles of Mohr's salt **(1)**	<u>Example of calculation</u> n = (2 × 3 =) 6 (mol) N = (6 × 6.02×10^{23} =) 3.612×10^{24} Correct answer no working scores 2 Ignore SF except 1SF Allow TE from incorrect moles	**(2)**

Question Number	Answer	Additional Guidance	Mark
24(b)	An answer that makes reference to the following point • **electrostatic attraction** between oppositely charged ions **(1)**	Allow **electrostatic attraction** between cations and anions	**(1)**

Question Number	Answer	Additional Guidance	Mark
24(c)	An explanation that makes reference to the following points: • diagram of U-tube/beaker with electrodes and solution or diagram of microscope slide with electrodes (and filter paper dampened) and solution in the centre **(1)** • complete viable circuit **(1)** • blue colour at the negative electrode/cathode **(1)** • yellow colour at the positive electrode/anode **(1)**	Accept points made in annotated diagrams   Allow (1) for colours reversed Allow (1) if electrodes reversed Allow ammeter/light bulb showing conductivity for (1) instead of M3 and M4 if such included in M2 Penalise incorrect anion	**(4)**

(Total for Question 24 = 11 marks)

TOTAL FOR SECTION B = 60 MARKS
TOTAL FOR PAPER = 80 MARKS