GradeMax

Pearson

Mark Scheme (Results)

Summer 2026

Pearson Edexcel International Advanced Subsidiary Level In Chemistry
WCH11/01

GradeMax

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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** (1.20×10^{24}) ***A*** *is incorrect because this is the number of molecules in 0.5 mol of hydrogen peroxide* ***B*** *is incorrect because this is the number of different atoms in 0.5 mol of hydrogen peroxide* ***D*** *is incorrect because this is the number of atoms in 1 mol of hydrogen peroxide*	**(1)** Choose an item.

Question Number	Answer	Mark
2	**The only correct answer is D** (5 : 1) ***A*** *is incorrect because this is the mass ratio* ***B*** *is incorrect because this is the whole number ratio if the atomic number of neon has been used* ***C*** *is incorrect because this is the neon : helium ratio*	**(1)** Choose an item.

Question Number	Answer	Mark
3	**The only correct answer is B** (0.080) ***A*** *is incorrect because that is the number of moles of hydrated sodium carbonate* ***C*** *is incorrect because the water of crystallisation has not been included in the* M_r *and the volume of water has not been taken into account* ***D*** *is incorrect because the water of crystallisation has not been included in the* M_r	**(1)** Choose an item.

Question Number	Answer	Mark
4	**The only correct answer is A** (6 12 6) ***B*** *is incorrect because the 3d electrons have been put into the 4p subshell* ***C*** *is incorrect because two of the 3d electrons have been removed instead of the 4s* ***D*** *is incorrect because this is the electron configuration of the iron atom*	**(1)** Choose an item.

Question Number	Answer	Mark
5	**The only correct answer is D** (79, 81, 158, 160 and 162) ***A*** *is incorrect because these are the values for the bromine atoms only and not bromine molecules* ***B*** *is incorrect because these are the values for the bromine atoms and the* ^{79}Br-^{81}Br *molecule only* ***C*** *is incorrect because these are the values for the bromine atoms, the* ^{79}Br-^{79}Br *and* ^{81}Br-^{81}Br *molecules only*	**(1)** Choose an item.

Question Number	Answer	Mark
6	**The only correct answer is A** (electrons in the same orbital have opposite spins) ***B*** *is incorrect because the electrons have opposite spins, not circular motion* ***C*** *is incorrect because this is a correct statement but is irrelevant* ***D*** *is incorrect because electrons in the same orbital have the same energy*	**(1)** Choose an item.

Question Number	Answer	Mark
7	**The only correct answer is A** (lithium ions have a smaller ionic radius than sodium ions) ***B*** *is incorrect because the number of outer shell electrons is the same for both lithium and sodium* ***C*** *is incorrect because the lithium ion has a larger charge density than the sodium ion* ***D*** *is incorrect because electrical conductivity does not affect the melting temperature of metals*	**(1)** Choose an item.

Question Number	Answer	Mark
8	**The only correct answer is A** (blue yellow) ***B*** *is incorrect because this would be seen if both ions moved to the positive electrode* ***C*** *is incorrect because this would be seen if only copper ions moved (to the negative electrode)* ***D*** *is incorrect because this would be seen if copper ions were negative and chromate ions were positive*	**(1)** Choose an item.

Question Number	Answer	Mark
9	**The only correct answer is D** (covalent, dative covalent and ionic) ***A*** *is incorrect because this does not include the bonding in the ammonium ion* ***B*** *is incorrect because the ammonium ion has a dative covalent bond* ***C*** *is incorrect because the bonding between the ions is ionic*	**(1)** Choose an item.

Question Number	Answer	Mark
10(a)	**The only correct answer is C** (NH_3) ***A*** *is incorrect because* BF_3 *is trigonal planar so dipole moments cancel* ***B*** *is incorrect because* CO_2 *is linear so dipole moments cancel* ***D*** *is incorrect because* SF_6 *is octahedral so dipole moments cancel*	**(1)** Choose an item.

Question Number	Answer	Mark
10(b)	**The only correct answer is A** (B−F) ***B*** *is incorrect because C and O are closer in the periodic table than B and F* ***C*** *is incorrect because Si and Cl are closer in the periodic table than B and F* ***D*** *is incorrect because P and S are closer in the periodic table than B and F*	**(1)** Choose an item.

Question Number	Answer	Mark
11	**The only correct answer is B** (LiI) ***A*** *is incorrect because iodide ions are more easily polarised than bromide ions* ***C*** *is incorrect because lithium ions polarise anions more than potassium ions and iodide ions are more easily polarised than fluoride ions* ***D*** *is incorrect because lithium ions polarise anions more than potassium ions and iodide ions are more easily polarised than chloride ions*	**(1)** Choose an item.

Question Number	Answer	Mark
12	**The only correct answer is C** (some outer shell electrons are free to move through the lattice) ***A*** *is incorrect because metal ions cannot move in a lattice* ***B*** *is incorrect because the main reason for the good conductivity of metal is the movement of electrons* ***D*** *is incorrect because inner shell electrons are not free to move*	**(1)** Choose an item.

Question Number	Answer	Mark
13	**The only correct answer is D** (2,3-dimethylbut-2-ene) ***A*** *is incorrect because the longest carbon chain has four carbon atoms* ***B*** *is incorrect because the longest carbon chain has four carbon atoms* ***C*** *is incorrect because the carbon-carbon double bond is between carbon atoms 2 and 3 in the monomer carbon chain*	**(1)** Choose an item.

Question Number	Answer	Mark
14	**The only correct answer is C** (93%) ***A*** *is incorrect because the molar mass of CO has not been multiplied by 2* ***B*** *is incorrect because this is the mole ratio of CO:H_2 in the product mixture* ***D*** *is incorrect because the molar mass of hydrogen has not been multiplied by 2*	**(1)** Choose an item.

Question Number	Answer	Mark
15(a)	**The only correct answer is C** (60) ***A*** *is incorrect because that is the volume of CO produced* ***B*** *is incorrect because that is the volume of methane remaining* ***D*** *is incorrect because this volume includes gaseous water*	**(1)** Choose an item.

Question Number	Answer	Mark
15(b)	**The only correct answer is B** (it is toxic at low concentrations) ***A*** *is incorrect because CO is not an acidic gas* ***C*** *is incorrect because CO is not classified as a major greenhouse gas so it does not contribute to global warming* ***D*** *is incorrect because CO is not an ozone depleting gas*	**(1)** Choose an item.

Question Number	Answer	Mark
16(a)	**The only correct answer is D** (4,4-dimethylcyclopentene) ***A*** *is incorrect because the numbering of the ring starts with the alkene carbon and not with the methyl groups* ***B*** *is incorrect because the numbering of the ring starts with the alkene carbon* ***C*** *is incorrect because the carbon atoms in the alkene functional group are 1 and 2 and the methyl groups are not on the adjacent carbon*	**(1)** Choose an item.

Question Number	Answer	Mark
16(b)	**The only correct answer is D** (19) ***A*** *is incorrect because this is only the number of single C-C bonds in the molecule* ***B*** *is incorrect because this is only the number of single C-C bonds and the sigma component of the C-C double bond in the molecule* ***C*** *is incorrect because this is only the number of single C-C bonds and the sigma component of the C-C double bond and the six C-H bonds in the two methyl groups*	**(1)** Choose an item.

Question Number	Answer	Mark
16(c)	**The only correct answer is A** (alcohol) ***B*** *is incorrect because at room temperature an aldehyde is not formed* ***C*** *is incorrect because at room temperature a carboxylic acid is not formed* ***D*** *is incorrect because at room temperature a ketone is not formed*	**(1)** Choose an item.

TOTAL FOR SECTION A = 20 MARKS

Section B

Question Number	Answer	Additional Guidance	Mark
17(a)(i)	An answer that makes reference to the following point: • $Ne(g) \rightarrow Ne^{+}(g) + e^{(-)}$	Allow $Ne(g) - e^{(-)} \rightarrow Ne^{+}(g)$ Ignore state symbol for e^{-}	**(1)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
17(a)(ii)	An answer that makes reference to the following points: (neon IE is greater than fluorine IE because) • neon has a greater nuclear charge / more protons than fluorine / proton number increases **(1)** • the (outer) electron removed is in the same (quantum / sub) shell (as in fluorine) **(1)** (neon IE is greater than sodium IE because) • in sodium the (outer) electron removed has more shielding / has more electron repulsion from the inner shells (of electrons) **(1)** • in sodium the (outer) electron removed is in a higher (quantum) shell / higher energy level / further from the nucleus **(1)** • (so) the increased shielding / greater distance (from the nucleus) outweighs the increased nuclear charge / number of protons (that results in a much greater ionisation energy difference) **(1)**	Use of ionic radius/radii penalise once only Ignore Ne has a full outer shell/Ne is stable Ignore electron configurations Answers must be comparative Allow Ne and F in same period / electron in 2p Ignore references to same/similar shielding in Ne/F Ignore reference to repulsion between paired electrons Allow (electron removed from) Na is in period 3 /3s **and** Ne is in period 2 / 2p	**(5)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
17(b)(i)	• calculation of weighted mean / average **(1)** • answer to 4 SF **(1)**	Example of calculation (80 × 2.35) + (82 × 11.61) + (83× 11.5) + (84 × 56.9) + (86 × 17.68) (188 + 952.02 + 954.5 + 4779.6 + 1520.48) ÷ 100 = 83.946 = 83.95 or (188 + 952.02 + 954.5 + 4779.6 + 1520.48) ÷ 100.04 = 83.9124 = 83.91 Correct answer with no working scores (2) Ignore use of g mol^{-1} Do not award use of 'g' TE on arithmetic error provided five isotopic values used and answer given to 4 SF **and** within the range 80-86	**(2)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
17(b)(ii)	An answer that makes reference to the following points: • ^{80}Kr **(1)** • because the smaller the mass (of the ion the greater the deflection) **(1)**	Accept lightest / smallest m/z ratio Allow converse reason M2 dependent on M1	**(2)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
17(c)(i) **Clip with (c)(ii)**	An answer that makes reference to the following points: • 2 bond pairs **and** 3 lone pairs		**(1)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
17(c)(ii) **Clip with (c)(i)**	An answer that makes reference to the following points: • electron pairs repel to minimum repulsion **(1)** • lone pairs repel more than bond pairs **(1)** • so the bond pairs must be axial /opposite each other (lone pairs being further apart in the equatorial plane) **(1)**	Penalise use of bp or lp once only unless qualified Allow electron pairs repel to maximum separation / as far apart as possible Allow bond pairs for electron pairs Do not award atoms repelling Allow annotated diagrams Ignore 180° bond angle	**(3)** Choose an item.

(Total for Question 17 = 14 marks)

Question Number	Answer	Additional Guidance	Mark
18(a)	An answer that makes reference to the following point: • equation	 $2Na + Cl_2 \rightarrow 2NaCl$ Ignore state symbols even if incorrect Allow multiples Do not award ⇌ or =	**(1)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
18(b)	An explanation that makes reference to the following points: • sodium has positive (cat)**ions** surrounded by **delocalised** electrons (in a giant metallic lattice) **(1)** • the bonds are non-directional (between the delocalised electrons and the ions) **(1)** • sodium chloride has ionic bonding / giant ionic lattice / is ionic **(1)** • when hammered / force is applied the ions with the same charge become adjacent and repel splitting the structure **(1)**	Allow annotated diagrams Allow: the **layers** of atoms / ions can slip /slide (when hammered / under applied pressure) Allow strong electrostatic attraction between positive / Na^+ and negative / Cl^- ions Do not award molecular structure / delocalised electrons / intermolecular forces for NaCl Do not award "giant" ionic bond	**(4)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
18(c)	An explanation that makes reference to the following points: • (charges are the same but) anion / halide radius increases **(1)** • ionic bond strength decreases / weaker attraction between the ions going down the group **and** less energy is required (to break the bonds in the lattice) **(1)**	Reference to molecule / covalent bonding / electronegativity scores 0 Allow going down Group 7 ionic radius increases Do not award atomic radius	**(2)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
18(d)(i)	An answer that makes reference to the following point: • equation species **(1)** • state symbols **(1)**	Scores (2) $NaHCO_3(s) + H^+(aq) \rightarrow Na^+(aq) + H_2O(l) + CO_2(g)$	**(2)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
18(d)(ii)	• moles CO_2 **(1)** • mass sodium hydrogencarbonate **(1)** • % $NaHCO_3$ **(1)**	Example of calculation $n = 74 \div 24000 = 3.0833 \times 10^{-3}$ (mol) $m = 3.083 \times 10^{-3} \times 84 = 0.259$ (g) % = $(0.259 \div 1.10) \times 100 = 23.545$(%) TE throughout Alternative method 1 $n = 1.1 \div 84 = 0.013$ (mol) $V = 0.013 \times 24 = 0.312$ (cm^3) % = $(74 \div 312) \times 100 = 23.7$ (%) Ignore SF except 1 SF Correct answer with no working scores 3	**(3)** Choose an item.

(Total for Question 18 = 12 marks)

Question Number	Answer	Additional Guidance	Mark
19(a)	An explanation that makes reference to the following points: • there is a (much) larger difference between the 4th and 5th ionisation energies **(1)** • (which shows that) the fifth electron is removed from a (quantum) shell closer to the nucleus **(1)**	Allow big jump for large difference Allow 5th electron is removed from an inner shell / removed from 1s / lower energy shell Ignore just there are four electrons in the outer shell	**(2)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
19(b)	An answer that makes reference to four of the following points: (diamond) • each carbon atom has **four** covalent bonds / **tetrahedral** structure **(1)** • (the strong) covalent bonds need lots of energy to break (so diamond is hard) **(1)** (graphite) • has (strong) **covalent** bonds between atoms in / within the layers (so can be used at high temperatures) **(1)** • weak intermolecular forces between the layers which can slide over each other (so can be used as a lubricant) **(1)**	Accept London forces / instantaneous dipole-induced dipole for intermolecular forces Allow dispersion / van der Waals for intermolecular forces Do not award id-id	**(4)** Choose an item.

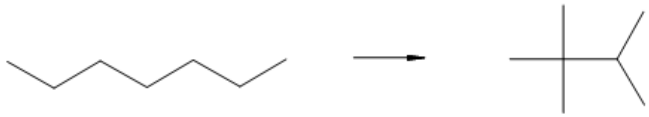
Question Number	Answer	Additional Guidance	Mark
19(c)	An answer that makes reference to the following points: • only **one / single** layer in thickness (so transparent) **(1)** • has **delocalised** electrons (so conducts electricity) **(1)**	Ignore free electrons	**(2)** Choose an item.

(Total for Question 19 = 8 marks)

Question Number	Answer	Additional Guidance	Mark
20(a)(i) **Clip with (a)(ii)**	• calculation of moles **(1)** • calculation of ratio **and** empirical formula **(1)**	<u>Example of calculation</u> C : H Moles 83.7 ÷ 12 = 6.975 16.3 1 : 2.3369 **and** C_3H_7 Correct answer with no working scores 1	**(2)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
20(a)(ii) **Clip with (a)(i)**	• ratio of empirical formula mass to M_r **and** molecular formula	<u>Example of calculation</u> [(3 × 12) + 7] n = 86 so n = 2 C_6H_{14} TE on answer to (a)(i) final answer must not have M_r greater than 86	**(1)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
20(a)(iii)	An answer that makes reference to the following point: • (C_6H_{14}) has several isomers	Allow (C_6H_{14}) exists as several different structural formulae / displayed formulae / compounds Allow reference to unknown chain length or branching Allow diagrams to illustrate the answer Do not award any reference to cycloalkanes	**(1)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
20(b)	• 	Ignore molecular / displayed / structural formulae Do not award if any other products are given eg H_2	**(1)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
20(c)(i)	An answer that makes reference to the following point: • (a carbon neutral fuel) forms the same amount of **carbon dioxide** (in combustion) as was absorbed (by photosynthesis / in its formation)	Allow no net emission of CO_2 to the atmosphere Do not award carbon for carbon dioxide	**(1)** Choose an item.

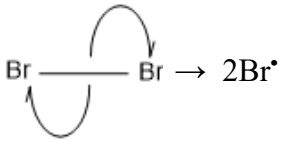
Question Number	Answer	Additional Guidance	Mark
20(c)(ii) **Clip with (c)(iii)**	• equation	<u>Example of equation</u> $C_8H_{18} + 12\frac{1}{2}O_2 \rightarrow 8CO_2 + 9H_2O$ Ignore state symbols even if incorrect Allow multiples	**(1)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
20(c)(iii) **Clip with (c)(ii)**	• calculation of moles of C_8H_{18} **(1)** • calculation of moles of CO_2 **(1)** • calculation of mass of CO_2 in kg **(1)**	<u>Example of calculation</u> n = (900 ÷ ((12 × 8) + 18) =) 7.8947 (mol) n = (7.8947 × 8 =) 63.158 (mol) m = ((63.158 × 44) ÷ 1000 =) 2.779 / 2.78 / 2.8 (kg) Ignore SF except 1 SF TE from incorrect molar ratio in the equation in (ii) TE throughout	**(3)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
20(c)(iv)	An answer that makes reference to one of the following points: • (CO_2 may be emitted) during the transport / processing of the biofuel • (CO_2 may be emitted) during the production of fertilisers / pesticides during the growing of the crops used to produce biofuels		**(1)** Choose an item.

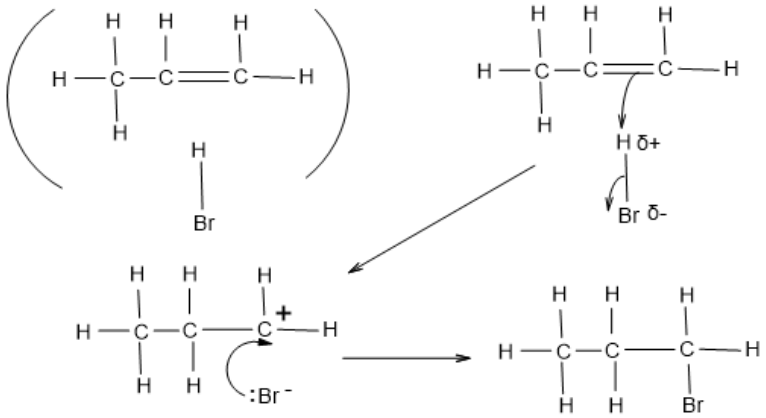
(Total for Question 20 = 11 marks)

Question Number	Answer	Additional Guidance	Mark
21(a)	An answer that makes reference to two of the following points: • same general formula **(1)** • (successive members) differing by CH_2 **(1)** • the same functional group **(1)** • same / similar chemical properties **(1)**	Apply list principle Allow correct named general formula example, eg C_nH_{2n} = alkene Do not award same molecular / empirical formula Allow named functional group, eg, C=C Ignore same / similar / trends in physical properties	**(2)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
21(b)(i) **Clip with (b)(ii)**	• balanced equation **(1)** • single headed arrows **(1)**	Use of HBr scores (0) Penalise omission of unpaired electrons once only in (b)(i) and (b)(ii) Penalise use of Cl once only in (b)(i) and (b)(ii) <u>Example of equation</u> 	**(2)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
21(b)(ii) **Clip with (b)(i)**	An answer that makes reference to the following points: • $CH_3CH_2CH_3 + Br^{\bullet} \rightarrow CH_3CH_2CH_2^{\bullet} + HBr$ **(1)** • $CH_3CH_2CH_2^{\bullet} + Br_2 \rightarrow CH_3CH_2CH_2Br + Br^{\bullet}$ **(1)**	Ignore curly arrows even if incorrect No TE on incorrect hydrocarbon	**(2)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
21(b)(iii)	An answer that makes reference to the following point: • di /poly brominated compounds are made or 2-bromopropane could be formed or hexane can be made or difficult to separate (1-bromopropane)	Allow multiple substitutions / further substitutions Ignore references to other products formed / side reactions / atom economy Ignore reference to major/minor products	**(1)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
21(c)(i)	• dipole shown on HBr **(1)** • arrow from C=C to H of HBr **(1)** • arrow from H-Br bond to Br or just beyond **(1)** • secondary carbocation of propane shown **(1)** • lone pair on bromide ion shown **(1)** • arrow from lone pair on bromide ion to C^+ on propane **(1)**	Example of mechanism  6 marking points scores 3 marks 4/5 marking points scores 2 marks 2/3 marking points scores 1 mark Penalise use of curly half arrows once only Penalise use of δ+ on carbocation once only Penalise omission of + on carbocation once only	**(3)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
21(c)(ii)	An answer that makes reference to the following point: • a primary **carbocation** is less stable (than a secondary carbocation)	Allow secondary carbocation is more stable (than primary carbocation) Do not award answers about product stability / it is a carbocation	**(1)** Choose an item.

Question Number	Answer	Additional Guidance	Mark
21(d)	• volume ethene required **(1)** • conversion of pressure and temperature units **(1)** • substitution, rearrangement and evaluation **(1)** • conversion to mass **(1)**	Example of calculation $V = (45 \times 100 \div 10^6 =) 4.5 \times 10^{-3}$ (m^3) 1.01×10^5 (Pa) 291.5 (K) $n = (\frac{1.01 \times 10^5 \times 4.5 \times 10^{-3}}{8.31 \times 291.5} =) 0.18763$ (mol) $m = (0.18763 \times 28.0 =) 5.25 / 5.254 / 5.2535$ (g) Ignore SF except 1SF TE throughout Adjustment for ppm can take place in step 1 or at the end Correct final answer with no working scores (4)	**(4)** Choose an item.

(Total for Question 21 = 15 marks)
TOTAL FOR SECTION B = 60 MARKS
TOTAL FOR PAPER = 80 MARKS