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EDEXCEL · GCSE COMBINED SCIENCE 1SC0

Chemistry — Higher Tier, Paper 2

June 2024 exam series

MARK SCHEME

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Mark Scheme (Results)

Summer 2024

Pearson Edexcel GCSE
In Combined Science Chemistry
(1SC0) Paper 2CH

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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.

Question number	Answer	Additional Guidance	Mark
1(a)	a diagram that includes • apparatus <u>that would collect and measure gas</u> using a gas syringe, measuring cylinder or burette (1) • label stating {**gas** syringe / measuring cylinder/ burette} (1)	mark independently ignore seals/ blockages MP2 for label, independent of drawing ignore any other labels	(2) AO1 2

Question number	Answer	Additional guidance	Mark
1(b)(i)	47	allow any value from 46-48	(1) AO3 2

Question number	Answer	Additional guidance	Mark
1(b)(ii)	answer in range 6.197 – 6.5 with or without working scores 3 Δy (gas volume) = 70 – (any no. in range 24-26) = 44-46 (1) Δx (time) = 7.1 – 0 = 7.1 (1) <u>Δy</u> = 6.197 – 6.479 (1) Δx	 allow 7-7.2 with or without working allow in these ranges: 6.197-6.5 scores 3 6.10-6.196 or 6.51-6.60 scores 2 6.0-6.099 or 6.61-6.70 scores 1	(3) AO3 2

		12.50 – 13.20 scores 2 13.21-13.75 scores 1 if answer is rounded, mark pre-rounded answer and ignore rounding if final answer not given or outside 6.0-6.70, or 12.50-13.75, then max 2 for MP1 and/ or MP2	

Question number	Answer	Additional guidance	Mark
1(c)	an explanation linking • rate is increased (1) • because high**er** surface area/ high**er** frequency of collisions/ more collisions <u>per second</u> (1)	if rate decreased scores 0 for whole answer allow (rate/ reaction) fast**er**, quick**er**, speed of reaction increases allow reaction takes less time/ dissolves faster reject particles have more energy for MP2 allow more area (of marble) for reactions to occur/ more contact (between particles) allow more chance of collisions/ collisions happen more often ignore more (successful) collisions alone	(2) AO1 1

Question number	Answer	Mark
1(d)	**B** using acid of a lower concentration is the only correct answer **C** is incorrect because the reactants are not changed **A** and **D** are incorrect because the reaction will be faster	(1) AO1 2

Total for Question 1 = 9 marks

Question number	Answer	Additional guidance	Mark
2(a)	A description to include • add **glowing** splint (1) • it relights (1)	 reject lit splint/ flame ignore description of forming glowing splint e.g. light splint and blow it out MP2 depends on MP1	(2) AO1 2

Question number	Answer	Additional guidance	Mark
2(b)	48.942 with or without working scores (2) • 0.529 x $\frac{4.200}{2.100}$ = 1.058 (1) • 50.000-1.058 = 48.942 (1)	48.94 or 48.9 (with or without working) scores 2 49 rounded from 48.942 scores 2 49 rounded from 49.471 scores 1 49 with no or other working scores 0 allow 0.529 x 2 = 1.058 allow ecf for 50 – calculated mass of oxygen 49.471 scores 1	(2) AO2 1

Question number	Answer	Additional guidance	Mark
2(c)(i)	An explanation linking: • (the gas atoms) have full <u>outer</u> shell(s) (1)	mark independently ignore mention of numbers of electrons allow outer orbital / outer energy level allow do not form ions	(2) AO1 1

	• so they do not {gain/ lose/ transfer/ share} <u>electrons</u> (1)	ignore it does not react/ does not gain a charge	

Question number	Answer	Mark
2(c)(ii)	**D** argon is unreactive is the only correct answer **A**, **B** and **C** are incorrect as they are irrelevant	(1) AO2 1

Question number	Answer		Mark
2(d)	A description including • (coastal ecosystems) store more (carbon/ carbon dioxide) (than forests) (1) • storing 2450 per unit area (for coastal) **AND** compared to 900 for non-coastal storage (1)	 allow coastal mangrove trees and/or coastal salt marsh OR just "they" ignore seagrass in MP1 ORA allow 2400-2500 allow 850-950 allow 350-450 for forests allow any reasonable relative values (2.5-3 x as much as non-coastal, 6-6.5 x as much as forests)	(2) AO3 1

Total for Question 2 = 9 marks

Question number	Answer	Additional guidance	Mark
3(a)(i)	a description including any two from • same **general formula** (1) • same functional group (1) • (neighbouring molecules) differ by CH_2 (1) • <u>similar</u> {**chemical** properties/ reactions} (1) • trend in physical properties (1)	 allow C_nH_{2n+2} ignore any other specific general formula ignore same (formula/ name ending} reject same {empirical / molecular} formula ignore they are all hydrocarbons ignore similar properties ignore **same** {chemical properties/ reactions} ignore similar properties/ similar physical properties allow specific examples e.g. increasing melting points	(2) AO1 1

Question number	Answer	Mark
3(a)(ii)	**C** C_8H_{18} is the only correct answer **A**, **B** and **D** are not alkanes	(1) AO2 1

Question number	Answer		Mark
3(b)	an explanation linking CARBON – max 2 • **carbon dioxide / CO_2** (1) • (carbon dioxide is a) greenhouse gas/ contributes to global warming (1) SULFUR – max 2 • **sulfur dioxide / SO_2** (1) • (sulfur dioxide causes) acid rain (1)	**MP2 depends on MP1 for both gases** ignore formation of water/ carbon monoxide/ carbon allow causes climate change allow specific effects of global warming allow sulfur trioxide ignore sulfur oxide(s) but allow ECF for MP3 allow forms sulfuric acid allow specific environmental effects – kills fish/ kills trees / breathing problems	(4) AO1 1

Question number	Answer	Additional guidance	Mark
3(c)	$2C_7H_{16} + 15O_2 \rightarrow 14CO + 16H_2O$ (2) all formulae correct **only** (1) balancing correct formulae only (1)	allow multiples inc. 7.5, 7, 8 ignore any state symbols allow incorrect cases or subscripts allow = for →	(2) AO2 1

Total for Question 3 = 9 marks

Question number	Answer	Mark
4(a)(i)	**A** 19% is the only correct answer **B**, **C** and **D** are incorrect because 3.5/18.0 x 100 = 19 to nearest whole number	(1) AO3 1

Question number	Answer	Additional guidance	Mark
4(a)(ii)	a description linking • leave (for more time) (1) • until volume of gas stops changing (1) OR • take repeated readings at different times (1) • which must be the same (1) OR • use more (iron) wool (1) • so iron in **excess** (1)	ignore references to testing oxygen ignore so oxygen fully reacts ignore repeat the experiment alone add excess (iron) wool scores 2	(2) AO3 3b

Question number	Answer	Additional guidance	Mark
4(b)(i)	a description including • add {ice/ cold water} <u>to beaker</u>(1)	allow add ice/cold water around tube A reject add condenser / cool delivery tube ignore cobalt chloride paper/ anhydrous copper	(2) AO3 3a

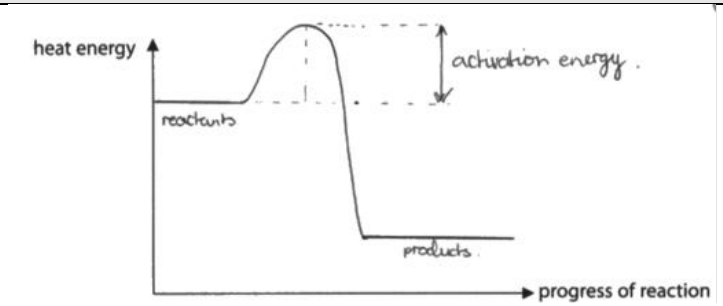
	• add limewater to <u>tube B</u> (1)	sulfate allow answer on diagram	

Question number	Answer		Mark
4(b)(ii)	• moles of carbon = $\frac{26.4}{44}$ = 0.6 (1) • moles of hydrogen = $\frac{(2 \times 5.4)}{18}$ = 0.6 (1) • ratio = 1 : 1 / empirical formula = CH / x = y (1) • **C_6H_6** (1)	allow moles of carbon dioxide = 0.6 moles of water/ hydrogen = 0.3 scores 0 for MP2 allow ECF for MP3 only depending on calculated moles 0.6: 0.3 (from MP2) = 2: 1 / C_2H / x = 2y scores MP1 and MP3 allow ratio of moles CO_2 : H_2O = 2:1 for MP3 no ECF for MP4 C_6H_6 or H_6C_6 is a stand alone mark for **MP4 only** the other 3 marks must be shown to be scored	(4) AO2 1

Total for Question 4 = 9 marks

Question number	Answer	Additional guidance	Mark
5(a)	periodic table is in atomic number order/ argon has atomic number 18 and potassium 19/ argon has 18 protons and potassium has 19 / (potassium has) high**er** atomic number	allow potassium (atoms) have more protons ignore electrons and neutrons allow proton number for atomic number ignore potassium is in group 1 and argon is in group 0	(1) AO2 1

Question number	Answer		Mark
5b(i)	KOH **AND** H_2	allow formulae in either order allow KHO ignore HOK / OHK / HKO / OKH allow incorrect case and subscript reject 2H	(1) AO1 1

Question number	Answer	Additional guidance	Mark
5(b)(ii)	 • products line (ends to) right of reactants line **AND** lower (1)	allow labels of names of reactants and products allow unlabelled reactants and products but reject if labels reversed allow energy at start/ end as labels	(2) AO2 1

	• curve with activation energy arrow from reactants level to peak of curve level **AND** labelled {activation energy/ E_A / E_{ACT} } (1)	arrow can point up, down or be double headed arrow can be inside or outside curve, but must be from and to correct levels on diagram allow missing arrowhead(s) allow ECF for MP2 if endothermic diagram is drawn	

Question number	Answer	Additional guidance	Mark
5(c)	an explanation linking • bond breaking {endothermic/ requires energy} (1) • bond forming {exothermic/ releases energy} (1) • less energy is released (forming bonds) than is required (to break bonds) (1)	allow heat for energy ignore number of bonds/ more bond breaking etc. MP3 dependant on scoring **MP1 AND MP2** energy needed to break bonds is more than energy released forming bonds (3)	(3) AO1 1

Question number	Answer		Mark
5(d)	-55 with or without working scores 4 BROKEN: 612 + 4(412) + 431 = 2691 (1) MADE: 412 + 348 + 338 + 4(412) = 2746 (1) DIFFERENCE: 2691 – 2746 (1) ANSWER: = **-** 55 (1)	 allow positive or negative allow positive or negative allow ecf for **+**broken **-**made allow ecf for addition or subtraction of 2 calculated values (working required) using bond energies	(4) AO2 1

	OR BROKEN: 612 + 431 = 1043 (1) MADE: 412 + 348 + 338 = 1098 (1) DIFFERENCE:1043 – 1098 (1) ANSWER: = **-** 55 (1)	allow positive or negative allow positive or negative allow ecf for +broken -made allow ecf for addition or subtraction of 2 calculated values (working must be seen) using bond energies with or without working, final answers of: -55 scores 4 (+) 55 scores 3 (+)293 scores 3 (+)705 scores 3 **-**486 scores 3 (+)486 scores 2	

Total for Question 5 = 11 marks

Question number	Answer	Mark
6(a)	**A** dark grey solid is the only correct answer **B**, **C** and **D** are incorrect as iodine is grey	(1) AO1 1

Question number	Answer	Additional guidance	Mark
6(b)	iron brom**ide**/ $FeBr_3$	ignore any (II) or (III) in answer allow $FeBr_2$ reject iron bromine if name and formula given, ignore formula	(1) AO1 1

Question number	Answer	Additional guidance	Mark
6(c)	$2Al + 3Br_2 \rightarrow 2AlBr_3$ LHS formulae only → (1) → RHS formula only (1) balancing correct formulae only (1)	allow multiples reject incorrect case or subscript e.g formulae with BR or AL e.g Br2, Br^2 reject incorrect charges ignore any state symbols	(3) AO2 1

Question number	Answer	Mark
6(d)(i)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **method** • react each salt solution with each halogen solution (relevant 6 mixtures, or all 9) • no need to add halogen to its own sodium salt **reaction of sodium chloride with halogen solutions** • bromine and iodine do not react • because chlorine is the most reactive halogen **reaction of sodium bromide with halogen solutions** • iodine will not react • because iodine is less reactive than bromine • chlorine will react • because chlorine is more reactive than bromine • sodium bromide + chlorine will turn orange/yell • bromine is displaced • $Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$ / word equation **reaction of sodium iodide with halogen solutions** • chlorine and bromine solutions both react • because chlorine and bromine are more reactive than iodine • solutions turn brown/ yellow/ black-grey solid • iodine is displaced • $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$ / word equation • $Br_2 + 2NaI \rightarrow 2NaBr + I_2$ / word equation **order of reactivity** • chlorine > bromine > iodine / less reactive down group	(6) AO2 2 AO3 1

	Cl_2	Br_2	I_2
$NaCl_{(aq)}$		x No reaction ∴ $Cl_2 > Br_2$	x No reaction ∴ $Cl_2 > I_2$
$NaBr_{(aq)}$	✓• orange solution ∴ $Cl_2 > Br_2$ $2NaBr + Cl_2 \rightarrow 2NaCl + Br_2$		x No reaction ∴ $Br_2 > I_2$
$NaI_{(aq)}$	✓• brown solution ∴ $Cl_2 > I_2$ $2NaI + Cl_2 \rightarrow 2NaCl + I_2$	✓• brown solution ∴ $Br_2 > I_2$ $2NaI + Br_2 \rightarrow 2NaBr + I_2$	

Level	**Mark**	**Descriptor**
	0	No rewardable material.
Level 1	1–2	The explanation attempts to link and apply knowledge and understanding of scientific enquiry, techniques and procedures, flawed or simplistic connections made between elements in the context of the question. Lines of reasoning are unsupported or unclear. (AO2) Analyses the scientific information but understanding and connections are flawed. (AO3) An incomplete plan that provides limited synthesis of understanding. (AO3)
Level 2	3–4	The explanation is mostly supported through linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, some logical connections made between elements in the context of the question. Lines of reasoning mostly supported through the application of relevant evidence. (AO2) Analyses the scientific information and provides some logical connections between scientific enquiry, techniques and procedures. (AO3) A partially completed plan that synthesises mostly relevant understanding, but not entirely coherently. (AO3)
Level 3	5–6	The explanation is supported throughout by linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, logical connections made between elements in the context of the question. Lines of reasoning are supported by sustained application of relevant evidence. (AO2) Analyses the scientific information and provide logical connections between scientific enquiry, techniques and procedures throughout. (AO3)

		A well-developed plan that synthesises relevant understanding coherently. (AO3)

Level	Mark	Descriptor Discard all incorrect material (<u>including additional observations</u>) and reject contradictory material. Allow potassium salts instead of sodium salts. Ignore explanations of reactivity.
	0	No awardable content
Level 1	1-2 **Additional Guidance** describes at least one suitable experiment AND one result/ at least 2 halogens put in order	• add chlorine to sodium bromide and reaction occurs (2) • add chlorine to sodium bromide and orange colour seen (2) • add chlorine, bromine and iodine to each of the three solutions (1) • $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$ (2) • bromine + sodium iodide = sodium bromide + iodine (2) • order of reactivity is chlorine > bromine > iodine (1) • table with the 9 combinations with no/ no correct results (1)
Level 2	3-4 **Additional Guidance** describes sufficient experiments that the order of reactivity can be determined **with results**	• mix every halogen with every salt. Chlorine with bromide goes orange, chlorine with iodide goes brown, bromine with iodide goes brown. (4) • table with the 9 combinations and correct ticks/ colours (4) • mix every halogen with every salt. Chlorine with bromide goes orange (3) • table with the 9 combinations and one correct tick/ colour (3)
Level 3	5-6 **Additional Guidance** describes sufficient experiments that the order of reactivity can be determined **with results**	• mix chlorine/bromide, chlorine/iodide, bromine/iodide. <u>These three all react</u> therefore chlorine> bromine> iodine. $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$ (6) • mix every halogen with every salt. <u>Only</u> reactions are: chlorine with bromide goes orange, chlorine with iodide goes brown,

	AND gives order of reactivity AND at least one equation showing displacement	bromine with iodide goes brown. chlorine> bromine> iodine. chlorine + sodium bromide = sodium chloride + bromine (6) • mix every halogen with every salt. Chlorine with bromide goes orange, chlorine with iodide goes brown, bromine with iodide goes brown. chlorine> bromine> iodine. chlorine + sodium bromide = sodium chlorine + bromide (5)

Question number	Answer	Additional guidance	Mark
6(d)(ii)	an explanation linking • **halide** (ions) {lose electrons / are oxidised} (1) • halogen (atoms/ molecules) {gain electrons / are reduced} (1)	half-equations can score MP1 and/or MP2 ignore halogens lose electrons reject the {halogen in the salt/ halogen being displaced} is reduced/ gains electrons	(2) AO1 1

Total for Question 6 = 13 marks