



Mark Scheme (Results)

Summer 2021

Pearson Edexcel International GCSE

In Chemistry (4CH1) Paper 1C and Science
(Double Award) (4SD0) Paper 1C

Question number	Answer	Notes	Marks												
1 (a)	<table><tr><th>Information</th><th>Substance</th></tr><tr><td>a good conductor of electricity</td><td>copper</td></tr><tr><td>an element that has a basic oxide</td><td>copper</td></tr><tr><td>a substance used as a fuel</td><td>methane</td></tr><tr><td>a major cause of acid rain</td><td>sulfur dioxide</td></tr><tr><td>a non-metallic element that is a solid at room temperature</td><td>iodine</td></tr></table>	Information	Substance	a good conductor of electricity	copper	an element that has a basic oxide	copper	a substance used as a fuel	methane	a major cause of acid rain	sulfur dioxide	a non-metallic element that is a solid at room temperature	iodine	ALLOW correct formulae	5
Information	Substance														
a good conductor of electricity	copper														
an element that has a basic oxide	copper														
a substance used as a fuel	methane														
a major cause of acid rain	sulfur dioxide														
a non-metallic element that is a solid at room temperature	iodine														
(b)	A description which refers to the following points M1 bubble/add (the gas/carbon dioxide) into limewater M2 (limewater) turns cloudy/milky	ACCEPT calcium hydroxide ACCEPT white precipitate M2 dep on use of limewater/calcium hydroxide in M1	2												
			Total 7												

Question number	Answer			Notes	Marks												
2 (a) (i)	<table><tr><th>Sub-atomic particle</th><th>Relative mass</th><th>Relative charge</th></tr><tr><td>electron</td><td>0.0005</td><td>-1</td></tr><tr><td>proton</td><td>1</td><td>+1</td></tr><tr><td>neutron</td><td>1</td><td>0</td></tr></table>			Sub-atomic particle	Relative mass	Relative charge	electron	0.0005	-1	proton	1	+1	neutron	1	0	1 mark for each correct answer ACCEPT minus one REJECT - unqualified ACCEPT one ALLOW +1 ACCEPT zero/none/ no charge	3
				Sub-atomic particle	Relative mass	Relative charge											
				electron	0.0005	-1											
				proton	1	+1											
	neutron	1	0														
(ii)	nucleus	1															
(b) (i)	U				1												
(ii)	25				1												
(iii)	W				1												
(iv)	Y and Z				1												

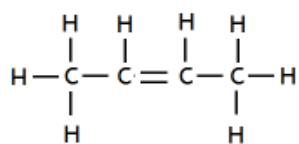
Question number	Answer	Notes	Marks
2 (c)	- sum of masses multiplied by percentages - division by 100 - answer given to 1 decimal place Example calculation M1 $(91.2 \times 20) + (8.80 \times 22)$ OR 2017.6 M2 $2017.6 \div 100$ OR 20.176 M3 20.2 OR answer from M2 given to 1d.p.	Correct answer of 20.2 with or without working scores 3 ACCEPT 2018 ACCEPT 20.18 correct answer without working scores 3 20.176 and 20.18 without working score 2 2020 scores M1 and M3 20 without working scores 0 20 with correct working scores 2	3 Total 11

Question number	Answer	Notes	Marks
3 (a) (i)	diffusion		1
(ii)	Any two from M1 stir (the mixture) M2 heat (the mixture) M3 grind the sugar or break into smaller pieces or increase its surface area	ALLOW shake/swirl ALLOW any description of heating	2
(b) (i)	(simple) distillation	REJECT fractional distillation ALLOW distilling OWTTE	1
(ii)	An explanation that links the following two points M1 (water/ vapour/ steam / gas) is cooled M2 and condenses OR in the condenser		2
			Total 6

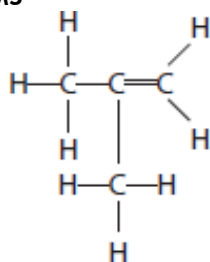
Question number	Answer	Notes	Marks
4 (a) (i)	A description including any three of the following M1 pour some solvent into a beaker /chromatography tank M2 place the paper in the solvent so that the food colourings are above the level of the solvent M3 leave the paper until the solvent reaches the level shown in the diagram/ has moved to near the top of the paper OWTTE M4 take the paper out and leave to dry	M1 and M2 can be scored from a labelled diagram ALLOW any named solvent	3
(ii)	one/1		1
(iii)	(F/it is) insoluble (in the solvent)/ does not dissolve (in the solvent)		1
(iv)	M1 E and H M2 they contain a dye that moved the furthest (distance up the paper)/ is closest to the solvent front / has the greatest R_f value	M2 dep on M1	2
(b)	M1 distance moved by solvent = 59-61mm and distance moved by the dye = 37-41mm M2 distance moved by the dye $\div$ distance moved by the solvent $\approx$ 0.67 M3 (the dye in food colouring) G	ALLOW distances in cm e.g. 6cm and 4cm If paper has been printed on A4 distances will be 51-53mm and 33-37mm ALLOW alternative methods	3
			Total 10

Question number	Answer	Notes	Marks								
5 (a) (i)	<table><tr><td>molecular formula</td><td>C₂H₆</td></tr><tr><td>name</td><td>ethane</td></tr><tr><td>empirical formula</td><td>CH₃</td></tr><tr><td>displayed formula</td><td><pre> H H H - C - C - H H H</pre></td></tr></table>	molecular formula	C ₂ H ₆	name	ethane	empirical formula	CH ₃	displayed formula	<pre> H H H - C - C - H H H</pre>	Penalise incorrect use of case, superscripts	3
molecular formula	C ₂ H ₆										
name	ethane										
empirical formula	CH ₃										
displayed formula	<pre> H H H - C - C - H H H</pre>										
(ii)	2 C ₂ H ₆ + 7 O ₂ → 4 CO ₂ + 6 H ₂ O	ACCEPT multiples and fractions	1								
(iii)	Any two from M1 carbon monoxide/CO M2 carbon/C M3 water (vapour)/steam/H ₂ O	ALLOW soot IGNORE carbon dioxide	2								
(b) (i)	A addition B is incorrect as it is not a decomposition reaction C is incorrect as no solid precipitate is produced D is incorrect as it is not a substitution reaction		1								
(ii)	Any two from M1 <pre> H H H H H - C = C - C - C - H H H</pre>	Do not accept displayed formulae of cyclic alkanes	2								

M2



M3



(iii) isomers

ALLOW cis-trans (E/Z)
isomers of but-2-ene for
both marks

ALLOW isomerism

1

Question number	Answer	Notes	Marks
5 (c) (i)	$\left[\begin{array}{cc} \text{H} & \text{CH}_3 \\ & \\ -\text{C} & - \text{C}- \\ & \\ \text{H} & \text{H} \end{array} \right]_n$ M1 correct repeat unit M2 extension bonds, brackets and n after brackets	If double bond between carbon atoms scores 0	2
(ii)	A discussion which refers to the following points M1 polymers/poly(propene) will remain in landfill indefinitely OWTTE M2 (as they) are inert /unreactive/do not biodegrade M3 burning produces toxic gases	ALLOW burning produces greenhouse gases	3
			Total 15

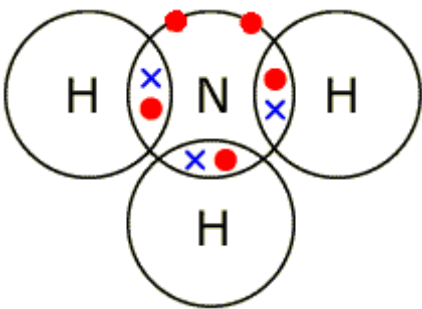
Question number	Answer	Notes	Marks
6 (a) (i)	Any 3 from M1 effervescence/bubbles/fizzing M2 moves M3 floats M4 disappears/gets smaller M5 vapour trail/steam	moves on surface scores M2 and M3 ALLOW dissolves IGNORE melts/heat produced IGNORE any reference to indicators	3
(ii)	An explanation that links the following two points M1 the universal indicator turns purple/blue M2 (because) OH ⁻ /hydroxide ions are present	ALLOW an alkaline solution /an alkali is produced / a solution of high pH is formed	2
(iii)	$2\text{Li} + 2\text{H}_2\text{O} \rightarrow 2\text{LiOH} + \text{H}_2$ M1 all formulae correct M2 balancing of correct formulae	ALLOW multiples and fractions M2 dep on M1	2
(b) (i)	An explanation that links the following two points M1 to remove any other ions/chemicals/ impurities/ contaminants/ compounds/substances (that may be on the wire) M2 (so that) they do not interfere with/mask the colour of the flame	ALLOW (so that) they do not affect the result (of the test) ALLOW (remove substances) that could colour the flame	2

(ii)	D yellow A is incorrect as sodium ions do not give a green flame B is incorrect as sodium ions do not give a lilac flame C is incorrect as sodium ions do not give a red flame		1
------	---	--	---

Question number	Answer	Notes	Marks
6 (c) (i)	K^+ and SO_4^{2-}		1
(ii)	An explanation that links the following four points M1 (potassium sulfate) has a giant (ionic) structure /lattice M2 electrostatic attraction between oppositely charged ions M3 (ionic bonds or forces / attractions between ions) are strong M4 a large amount of energy is needed to overcome the forces/break the bonds	ionic bonds are strong scores M3	4
			Total 15

Question number	Answer	Notes	Marks						
7 (a) (i)	→ magnesium chloride + hydrogen	ACCEPT in either order	1						
(b) (i)	<table><tr><td>temperature of the acid at the start in °C</td><td>22.4</td></tr><tr><td>highest temperature reached in °C</td><td>43.2</td></tr><tr><td>temperature rise in °C</td><td>20.8</td></tr></table>	temperature of the acid at the start in °C	22.4	highest temperature reached in °C	43.2	temperature rise in °C	20.8	ALLOW ECF from incorrect starting temperature	2
temperature of the acid at the start in °C	22.4								
highest temperature reached in °C	43.2								
temperature rise in °C	20.8								

Question number	Answer	Notes	Marks
7	(ii) - substitute correct values into $Q = mc\Delta T$ - evaluation Example calculation M1 $Q = 25 \times 4.2 \times 20.8$ M2 2184 (J)	Correct answer of 2184 or 2194 without working scores 2	2
	(iii) - find the amount of magnesium in moles - divide Q by n - convert answer in J/mol to kJ/mol - answer including sign Example calculation M1 $n(\text{Mg}) = 0.12 \div 24$ OR 0.005(0) M2 $Q \div n$ OR $2184 \div 0.005(0)$ OR 436,800 (J/mol) M3 $436,800 \div 1000$ OR 436.8 (kJ/mol) M4 – 436.8 (kJ/mol)	ALLOW 25.12g for m ACCEPT any number of sig figs except 1 ALLOW ECF from M1 ACCEPT use of 2180 or 2200 ALLOW ECF on incorrect answer to (ii) and/or M1 ALLOW ECF on incorrect answer to M2 ALLOW ECF on incorrect answer to M3 Correct answer with minus sign and without working scores 4 Correct answer without minus sign and without working scores 3 ACCEPT any number of sig figs except 1 throughout (ii) -438.8 or -438.9 also scores 4 (from 5.12g and 2194J in (ii))	4
			Total 9

Question number	Answer	Notes	Marks
8 (a)	A description which refers to the following six points Test for ammonium ions: M1 add sodium hydroxide (solution) (and warm) M2 test the gas with (damp) (red) litmus paper/(damp) universal indicator paper M3 (litmus) turns blue /(universal indicator) turns blue/purple (if ammonium ions are present) Test for sulfate ions: M4 add (dilute hydrochloric/nitric) acid M5 add barium chloride (solution) /barium nitrate (solution) M6 white precipitate (if sulfate ions are present)	ALLOW other alkalis No M2 or M3 if solution tested with litmus/ universal indicator paper M4 and M5 can be in either order No M4 or M6 if sulfuric acid added M6 dep on M5	6
(b) (i)	neutralisation	ALLOW acid-base OR acid-alkali	1
(ii)	$2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$	ALLOW multiples	1
(iii)	M1 3 bonding pairs correct M2 rest of molecule correct 	M2 dep on M1 ALLOW any combination of dots and crosses	2
Total 10			

Question number	Answer	Notes	Marks
9 (a) (i)	carbon dioxide/a gas is given off/escapes	REJECT incorrect gas	1
(ii)	to prevent acid/ liquid/ solution/ spray from leaving the flask OWTTE		1
(iii)	An explanation that links two of the following M1 (insoluble) calcium sulfate will form M2 which will form a coating/ layer on the marble chips M3 slowing down/ preventing/ stopping the reaction	M3 dep on M1 or M2	2
(b) (i)	An explanation that links the following four points M1 the curve is steep(est) at the start M2 because the (acid) concentration is high(est) M3 the curve becomes less steep as the solution/ acid is becoming more dilute M4 the curve levels off/ stops going up when the acid has all been used up OR M1 the curve is steep(est) at the start M2 because the reaction is fast(est) at the start M3 the curve becomes less steep because the reaction slows down M4 the curve levels off/stops going up when the acid has all been used up	ALLOW there are the most (acid) particles in solution ALLOW the curve becomes less steep as there are fewer acid particles/particles in solution IGNORE references to particles of marble chips IGNORE references to energy	4

(ii)	M1 curve drawn starting at the origin and below the original curve M2 curve levels off at 0.27 g + or – half a small square		2
------	---	--	---

Question number	Answer	Notes	Marks
9 (c)	An explanation that links the following four points M1 the rate of reaction increases/ the reaction is faster/ the reaction speeds up and any three from M2 because the particles gain (kinetic) energy /move faster M3 there are more collisions per unit time M4 more collisions/particles have energy greater than the activation energy M5 more collisions are successful	there are more frequent successful collisions scores M3 and M5	4 Total 14

Question number	Answer	Notes	Marks
10 (a) (i)	so that the (hot) lead does not react with oxygen/air (converting back into lead oxide)	ACCEPT so that lead is not oxidised (back to lead oxide)	1
(ii)	M1 repeat the heating M2 until the mass remains constant/ does not change	ACCEPT heat to constant mass for both marks	2
(b) (i)	4.66 (g)		1
(ii)	0.48 (g)		1
(iii)	- calculate the moles of lead and oxygen - divide by the smaller number - calculate the whole number ratio - give the empirical formula Example calculation M1 $\frac{4.66}{207}$ and $\frac{0.48}{16}$ OR 0.0225 and 0.03(00) M2 $\frac{0.0225}{0.0225}$ and $\frac{0.03(00)}{0.0225}$ OR 1:1.33 M3 1 x 3 and 1.33 x 3 OR 3:4 M4 Pb₃O₄	Division by atomic numbers or upside down calculation scores 0 3:4 ratio without working scores 3 Pb₃O₄ without working scores 4 ALLOW ECF from incorrect masses.	4

Question number	Answer	Notes	Marks
10 (c) (i)	$\text{Pb}(\text{NO}_3)_2 (\text{aq}) + 2\text{HCl} (\text{aq}) \rightarrow \text{PbCl}_2 (\text{s}) + 2\text{HNO}_3 (\text{aq})$	ALLOW any combination of uppercase and lowercase letters	1
(ii)	- calculate the amount of PbCl_2 - multiply the moles by the M_r of PbCl_2 - evaluation to show that the value is about 5 g Example calculation M1 $n(\text{PbCl}_2) = \frac{0.0370}{2}$ OR 0.0185 (mol) M2 mass of $\text{PbCl}_2 = 0.0185 \times 278$ (g) M3 5.143 (g)	MAX 1 for 0.0370×278 if no division by 2 in M1 ALLOW any number of sig figs 5.1, 5.14 and 5.143 g without working score 3 5 g without working scores 0 ALLOW alternative methods	3
			Total 13