

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Pearson Edexcel International GCSE		Centre Number	Candidate Number
Wednesday 16 January 2019			
Afternoon (Time: 1 hour)		Paper Reference 4CH0/2C	
Chemistry Unit: 4CH0 Paper: 2C			
You must have: Calculator, ruler			Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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2

Period

4	He	2
	Helium	

$$\begin{array}{c} 1 \\ \text{H} \\ 1 \end{array}$$

7	Li Lithium	9	Be Beryllium	10	B Boron	11	C Carbon	12	N Nitrogen	13	O Oxygen	14	F Fluorine	15	Ne Neon																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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37	Rb Rubidium	38	Sr Strontium	39	Y Yttrium	40	Zr Zirconium	41	Nb Niobium	42	Mo Molybdenum	43	Tc Technetium	44	Ru Ruthenium	45	Rh Rhodium	46	Pd Palladium	47	Ag Silver	48	Cd Cadmium	49	In Indium	50	Sn Tin	51	Sb Antimony	52	Te Tellurium	53	I Iodine	54	Xe Xenon	55	Cs Caesium	56	Ba Barium	57	La Lanthanum	58	Ce Cerium	59	Pr Praseodymium	60	Nd Neodymium	61	Pm Promethium	62	Sm Samarium	63	Eu Europium	64	Gd Gadolinium	65	Tb Terbium	66	Dy Dysprosium	67	Ho Holmium	68	Er Erbium	69	Tm Thulium	70	Yb Ytterbium	71	Lu Lutetium	72	Hf Hafnium	73	Ta Tantalum	74	W Tungsten	75	Re Rhenium	76	Os Osmium	77	Ir Iridium	78	Pt Platinum	79	Au Gold	80	Hg Mercury	81	Tl Thallium	82	Pb Lead	83	Bi Bismuth	84	Po Polonium	85	At Astatine	86	Rn Radon																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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Darmstadtium	106	106	107	107	108	108	109	109	110	110	111	111	112	112	113	113	114	114	115	115	116	116	117	117	118	118	119	119	120	120	121	121	122	122	123	123	124	124	125	125	126	126	127	127	128	128	129	129	130	130	131	131	132	132	133	133	134	134	135	135	136	136	137	137	138	138	139	139	140	140	141	141	142	142	143	143	144	144	145	145	146	146	147	147	148	148	149	149	150	150	151	151	152	152	153	153	154	154	155	155	156	156	157	157	158	158	159	159	160	160	161	161	162	162	163	163	164	164	165	165	166	166	167	167	168	168	169	169	170	170	171	171	172	172	173	173	174	174	175	175	176	176	177	177	178	178	179	179	180	180	181	181	182	182	183	183	184	184	185	185	186	186	187	187	188	188	189	189	190	190	191	191	192	192	193	193	194	194	195	195	196	196	197	197	198	198	199	199	200	200	201	201	202	202	203	203	204	204	205	205	206	206	207	207	208	208	209	209	210	210	211	211	212	212	213	213	214	214	215	215	216	216	217	217	218	218	219	219	220	220	221	221	222	222	223	223	224	224	225	225	226	226	227	227	228	228	229	229	230	230	231	231	232	232	233	233	234	234	235	235	236	236	237	237	238	238	239	239	240	240	241	241	242	242	243	243	244	244	245	245	246	246	247	247	248	248	249	249	250	250	251	251	252	252	253	253	254	254	255	255	256	256	257	257	258	258	259	259	260	260	261	261	262	262	263	263	264	264	265	265	266	266	267	267	268	268	269	269	270	270	271	271	272	272	273	273	274	274	275	275	276	276	277	277	278	278	279	279	280	280	281	281	282	282	283	283	284	284	285	285	286	286	287	287	288	288	289	289	290	290	291	291	292	292	293	293	294	294	295	295	296	296	297	297	298	298	299	299	300	300	301	301	302	302	303	303	304	304	305	305	306	306	307	307	308	308	309	309	310	310	311	311	312	312	313	313	314	314	315	315	316	316	317	317	318	318	319	319	320	320	321	321	322	322	323	323	324	324	325	325	326	326	327	327	328	328	329	329	330	330	331	331	332	332	333	333	334	334	335	335	336	336	337	337	338	338	339	339	340	340	341	341	342	342	343	343	344	344	345	345	346	346	347	347	348	348	349	349	350	350	351	351	352	352	353	353	354	354	355	355	356	356	357	357	358	358	359	359	360	360	361	361	362	362	363	363	364	364	365	365	366	366	367	367	368	368	369	369	370	370	371	371	372	372	373	373	374	374	375	375	376	376	377	377	378	378	379	379	380	380	381	381	382	382	383	383	384	384	385	385	386	386	387	387	388	388	389	389	390	390	391	391	392	392	393	393	394	394	395	395	396	396	397	397	398	398	399	399	400	400	401	401	402	402	403	403	404	404	405	405	406	406	407	407	408	408	409	409	410	410	411	411	412	412	413	413	414	414	415	415	416	416	417	417	418	418	419	419	420	420	421	421	422	422	423	423	424	424	425	425	426	426	427	427	428	428	429	429	430	430	431	431	432	432	433	433	434	434	435	435	436	436	437	437	438	438	439	439	440	440	441	441	442	442	443	443	444	444	445	445	446	446	447	447	448	448	449	449	450	450	451	451	452	452	453	453	454	454	455	455	456	456	457	457	458	458	459	459	460	460	461	461	462	462	463	463	464	464	465	465	466	466	467	467	468	468	469	469	470	470	471	471	472	472	473	473	474	474	475	475	476	476	477	477	478	478	479	479	480	480	481	481	482	482	483	483	484	484	485	485	486	486	487	487	488	488	489	489	490	490	491	491	492	492	493	493	494	494	495	495	496	496	497	497	498	498	499	499	500	500	501	501	502	502	503	503	504	504	505	505	506	506	507	507	508	508	509	509	510	510	511	511	512	512	513	513	514	514	515	515	516	516	517	517	518	518	519	519	520	520	521	521	522	522	523	523	524	524	525	525	526	526	527	527	528	528	529	529	530	530	531	531	532	532	533	533	534	534	535	535	536	536	537	537	538	538	539	539	540	540	541	541	542	542	543	543	544	544	545	545	546	546	547	547	548	548	549	549	550	550	551	551	552	552	553	553	554	554	555	555	556	556	557	557	558	558	559	559	560	560	561	561	562	562	563	563	564	564	565	565	566	566	567	567	568	568	569	569	570	570	571	571	572	572	573	573	574	574	575	575	576	576	577	577	578	578	579	579	580	580	581	581	582	582	583	583	584	584	585	585	586	586	587	587	588	588	589	589	590	590	591	591	592	592	593	593	594	594	595	595	596	596	597	597	598	598	599	599	600	600	601	601	602	602	603	603	604	604	605	605	606	606	607	607	608	608	609	609	610	610	611	611	612	612	613	613	614	614	615	615	616	616	617	617	618	618	619	619	620	620	621	621	622	622	623	623	624	624	625	625	626	626	627	627	628	628	629	629	630	630	631	631	632	632	633	633	634	634	635	635	636	636	637	637	638	638	639	639	640	640	641	641	642	642	643	643	644	644	645	645	646	646	647	647	648	648	649	649	650	650	651	651	652	652	653	653	654	654	655	655	656	656	657	657	658	658	659	659	660	660	661	661	662	662	663	663	664	664	665	665	666	666	667	667	668	668	669	669	670	670	671	671	672	672	673	673	674	674	675	675	676	676	677	677	678	678	679	679	680	680	681	681	682	682	683	683	684	684	685	685	686	686	687	687	688	688	689	689	690	690	691	691	692	692	693	693	694	694	695	695	696	696	697	697	698	698	699	699	700	700	701	701	702	702	703	703	704	704	705	705	706	706	707	707	708	708	709	709	710	710	711	711	712	712	713	713	714	714	715	715	716	716	717	717	718	718	719	719	720	720	721	721	722	722	723	723	724	724	725	725	726	726	727	727	728	728	729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Key

Relative atomic mass	Symbol	Name	Atomic number
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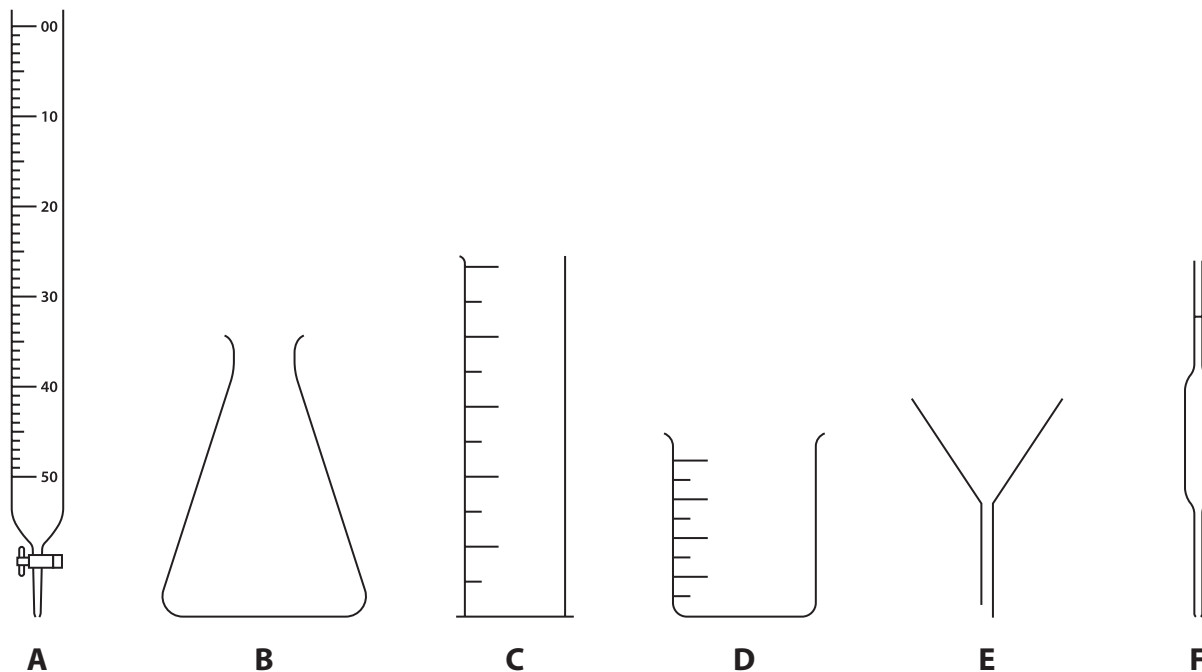
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Answer ALL questions.

1 The diagram shows six pieces of apparatus that are used in the laboratory.



The table lists the names of four pieces of apparatus.

Complete the table by giving a letter, A, B, C, D, E or F, to identify each piece of apparatus listed.

(4)

Name of apparatus	Letter
beaker	
burette	
measuring cylinder	
pipette	

(Total for Question 1 = 4 marks)



2 Rubidium is an element in Group 1 of the Periodic Table.

A sample of rubidium contains two isotopes, ${}_{37}^{85}\text{Rb}$ and ${}_{37}^{87}\text{Rb}$

(a) (i) State how the nuclei of the two isotopes are similar.

(1)

(ii) State how the nuclei of the two isotopes are different.

(1)

(iii) How many electrons are in the outer shell of a rubidium atom?

(1)

- ☐ A 1
- ☐ B 3
- ☐ C 9
- ☐ D 37

(b) The relative abundances of the two isotopes in the sample of rubidium are

${}_{37}^{85}\text{Rb}$ 72.2 % ${}_{37}^{87}\text{Rb}$ 27.8 %

Calculate the relative atomic mass of rubidium.

Give your answer to one decimal place.

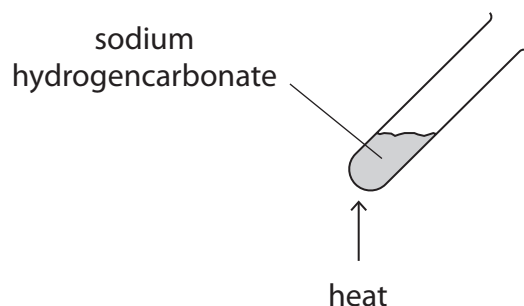
(2)

relative atomic mass =

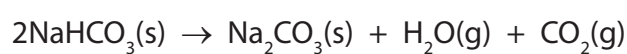
(Total for Question 2 = 5 marks)



- 3 A student uses this apparatus to investigate the action of heat on sodium hydrogencarbonate (NaHCO_3).



The equation for the reaction is



- (a) (i) State the type of reaction taking place.

(1)

- (ii) Describe a test to show that the gas given off is carbon dioxide.

(2)

test

result

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(b) The student heats a 1.00 g sample of sodium hydrogencarbonate for one minute.

He then measures the mass of solid left in the test tube.

He repeats the experiment four times, heating separate samples of mass 1.00 g for a different number of minutes each time.

The table shows the student's results.

Time in minutes	1	2	3	4	5
Mass of solid left in test tube in g	0.89	0.78	0.69	0.63	0.63

(i) State why the mass of solid in each test tube decreases.

(1)

(ii) Suggest why the mass of solid stops decreasing after four minutes.

(1)

(Total for Question 3 = 5 marks)



4 Sodium reacts with fluorine to form sodium fluoride.

The reaction is very exothermic.

(a) State what is meant by the term **exothermic**.

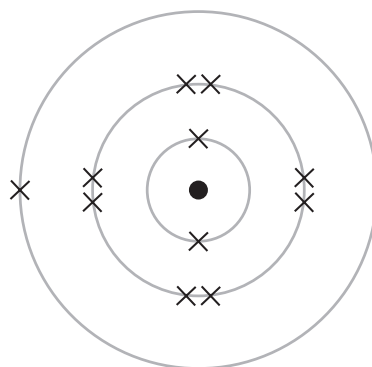
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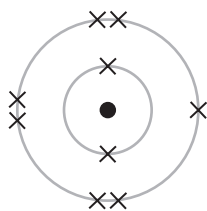
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(b) The diagram shows the electronic configuration of a sodium atom.

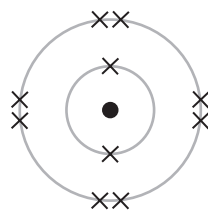


Which of these diagrams shows the electronic configuration of a fluorine atom?

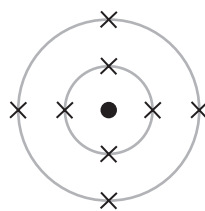
(1)



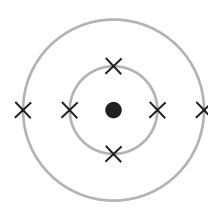
A ☐



B ☐



C ☐

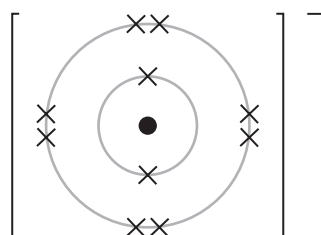


D ☐



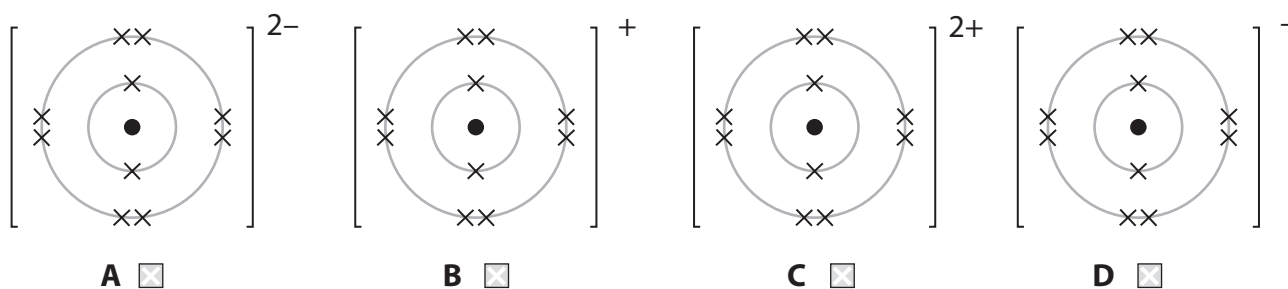
(c) Sodium ions and fluoride ions are formed when sodium reacts with fluorine.

The diagram shows the electronic configuration and charge of a fluoride ion.



Which of these diagrams shows the electronic configuration and charge of a sodium ion?

(1)



(d) Explain, in terms of its structure and bonding, why sodium fluoride has a high melting point.

(4)

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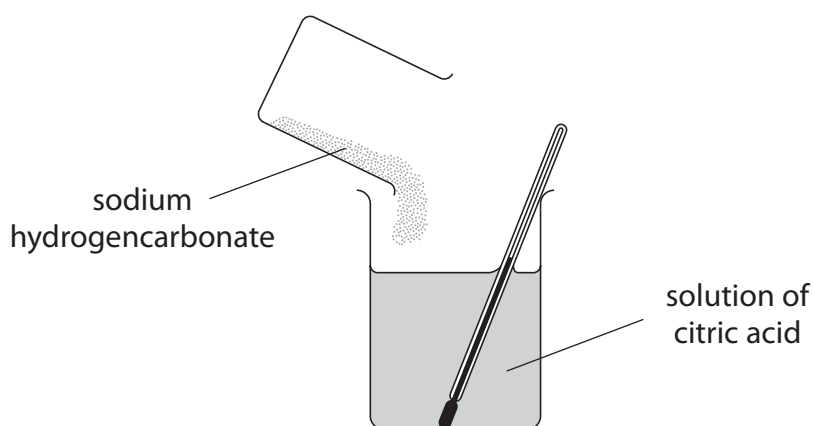
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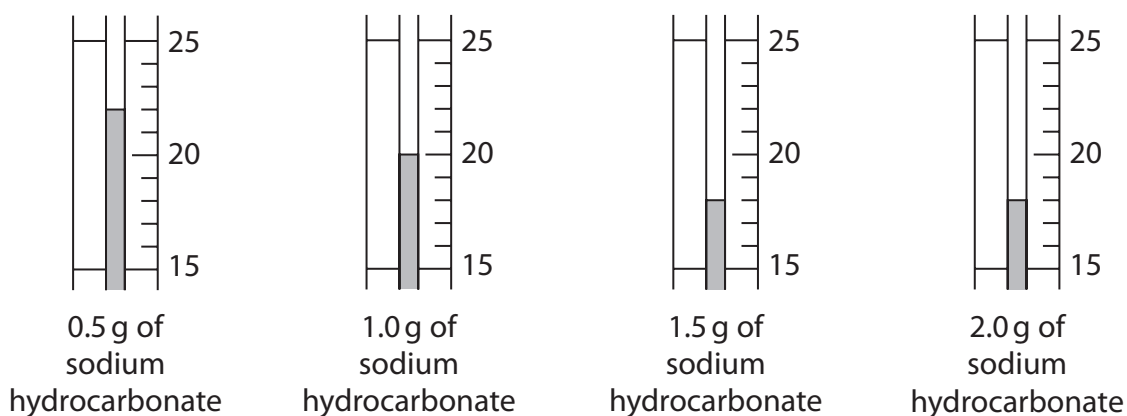
(Total for Question 4 = 7 marks)



- 5 A student finds the temperature change when a mass of 0.5 g of sodium hydrogencarbonate is added to 50 cm³ of a solution of citric acid.
- She repeats the experiment using masses of 1.0 g, 1.5 g and 2.0 g of sodium hydrogencarbonate.



- (a) The diagrams of the thermometer show the lowest temperature reached, in °C, for each experiment.



Use the diagrams to complete the table of results.

(2)

Mass of sodium hydrogencarbonate in g	Initial temperature in °C	Lowest temperature reached in °C	Decrease in temperature in °C
0.5	25		
1.0	24		
1.5	23		
2.0	23		

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(b) Another student does the experiment.

The table shows his results.

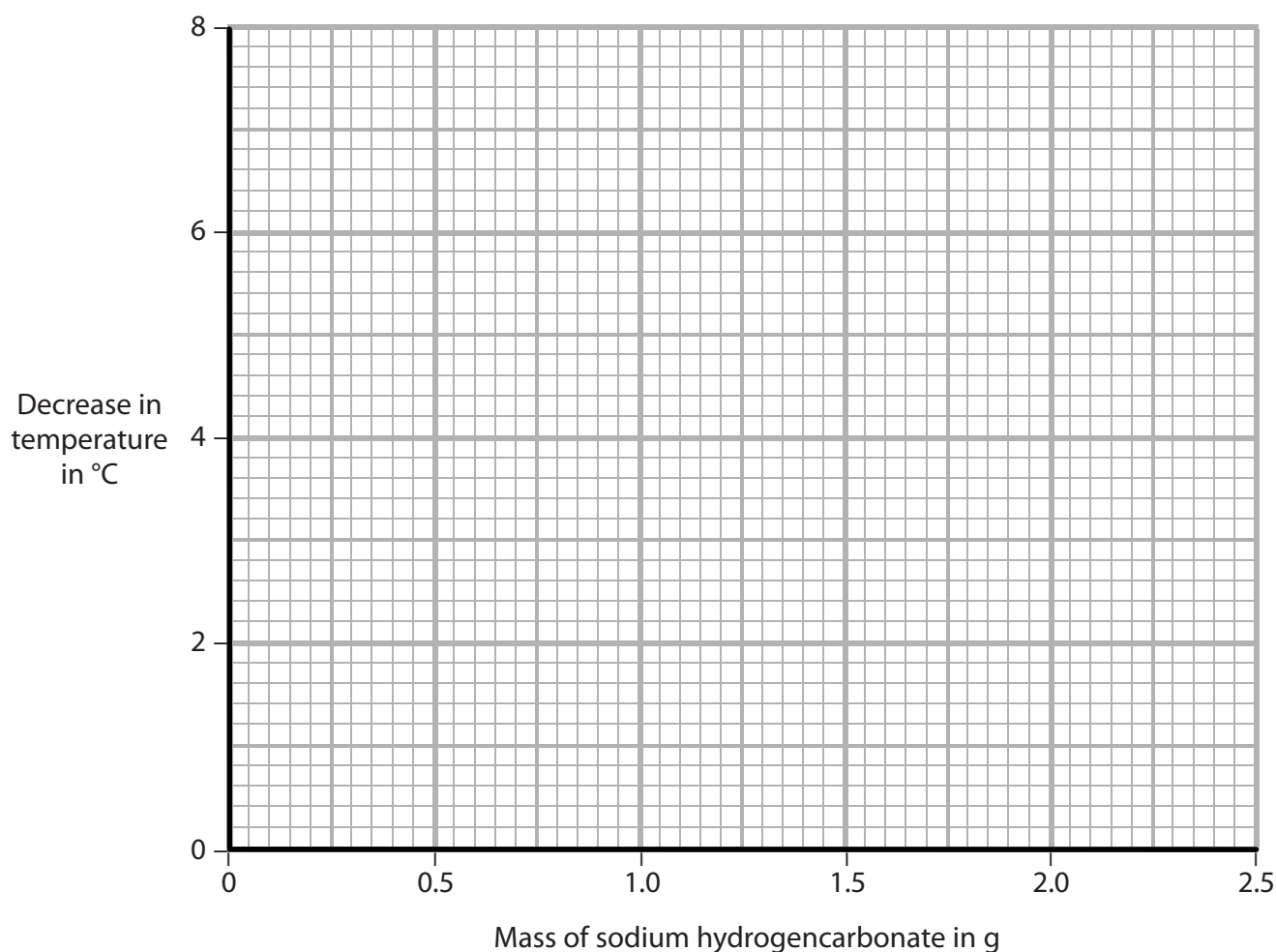
Mass of sodium hydrogencarbonate in g	0.5	1.0	1.5	2.0	2.5
Decrease in temperature in °C	2	4	6	6	6

(i) Plot this student's results on the grid.

Draw a straight line of best fit through the first three points and another straight line of best fit through the last two points.

Make sure the two lines cross.

(3)



(ii) Use your graph to find the mass of sodium hydrogencarbonate required to produce a decrease in temperature of 3 °C.

(1)

mass = g

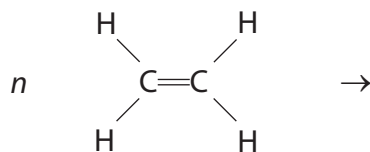
(Total for Question 5 = 6 marks)



6 Poly(ethene) is an addition polymer made from ethene, C_2H_4

(a) Complete the equation to show the formation of poly(ethene) from ethene.

(2)



(b) State why poly(ethene) is described as an addition polymer, not a condensation polymer.

(1)

(c) Many shopping bags are made of poly(ethene).

(i) One useful property of poly(ethene) is that it is inert so it does not react with food.

Explain two other properties of poly(ethene) that make it useful for shopping bags.

(2)

1

2

(ii) Another property of poly(ethene) is that it is non-biodegradable.

Two methods of disposing of poly(ethene) are landfill and burning.

Give one problem caused by each method of disposal.

(2)

landfill

burning

(Total for Question 6 = 7 marks)



7 Magnesium can be obtained by the electrolysis of magnesium chloride.

Solid magnesium chloride is obtained from seawater.

The magnesium chloride is melted and then electrolysed. The positive electrode is made of graphite and the negative electrode is made of steel.

Magnesium forms at the negative electrode. Chlorine forms at the positive electrode.

(a) Explain why the magnesium chloride has to be melted before it can be electrolysed. (2)

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(b) Write an ionic half-equation to represent the formation of magnesium at the negative electrode. (1)

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(c) Suggest why steel is **not** used for the positive electrode. (1)

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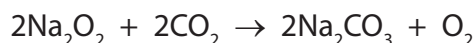
(Total for Question 7 = 4 marks)

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- 8 Submarines that spend a long time underwater use sodium peroxide (Na_2O_2) to absorb carbon dioxide (CO_2) from the air in the submarine.

The equation for the reaction is



- (a) There are 140 people on the submarine.

Each person produces 480 dm^3 of carbon dioxide per day.

- (i) Calculate the total amount, in moles, of carbon dioxide produced on the submarine in one day.

[assume 1 mol of CO_2 occupies 24.0 dm^3]

(2)

amount of $\text{CO}_2 = \dots\dots\dots$ mol

- (ii) Calculate the mass, in kilograms, of sodium peroxide required to absorb all of the carbon dioxide produced in the submarine in one day.

[M_r of $\text{Na}_2\text{O}_2 = 78.0$]

(2)

mass of $\text{Na}_2\text{O}_2 = \dots\dots\dots$ kg

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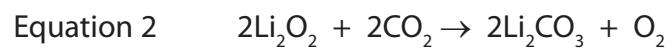
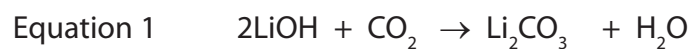
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- (b) Spaceships use either lithium hydroxide (LiOH) or lithium peroxide (Li₂O₂) to absorb carbon dioxide.

The equations for the two reactions are



Using information from the equations, give two reasons why lithium peroxide is more suitable than lithium hydroxide for use on spaceships.

(2)

1

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2

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(Total for Question 8 = 6 marks)

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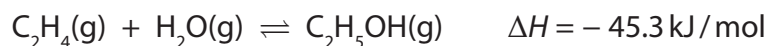
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- 9 Ethanol ($\text{C}_2\text{H}_5\text{OH}$) is made in industry by reacting ethene (C_2H_4) with steam at a temperature of 300°C and a pressure of 70 atm. The percentage yield of ethanol is 43%.

The equation for the reaction is



- (a) (i) State what the symbols $\rightleftharpoons$ and ΔH represent.

(2)

$\rightleftharpoons$

ΔH

- (ii) Name the catalyst used in this industrial process.

(1)

.....

- (b) (i) Predict the effect on the yield of ethanol if the reaction is carried out at a temperature lower than 300°C , but at the same pressure of 70 atm.
[assume reaction reaches equilibrium]

Give a reason for your answer.

(2)

.....

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- (ii) Predict the effect on the yield of ethanol if the reaction is carried out at a pressure lower than 70 atm, but at the same temperature of 300°C .
[assume reaction reaches equilibrium]

Give a reason for your answer.

(2)

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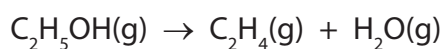
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- (c) One method of obtaining ethene is by cracking crude oil fractions.

Ethene can also be made by passing ethanol vapour over a hot aluminium oxide catalyst.

The equation for the reaction is



- (i) State the type of reaction taking place.

(1)

- (ii) Suggest why it may be necessary, in the future, to make ethene using this reaction rather than by cracking crude oil fractions.

(1)

(Total for Question 9 = 9 marks)

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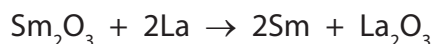
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10 Samarium, Sm, is a metal used to make powerful magnets.

(a) Samarium can be obtained by heating its oxide with lanthanum, La.



The table shows the melting points of the substances involved in this reaction.

Substance	samarium	samarium oxide	lanthanum	lanthanum oxide
Melting point in °C	1072	2335	920	2315

(i) The operating temperature for this reaction is 1030 °C.

Explain which substance in the table could exist as a liquid at this temperature.

(2)

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(ii) Samarium oxide neutralises hydrochloric acid to form samarium chloride, SmCl_3

Write a chemical equation for this reaction.

(1)

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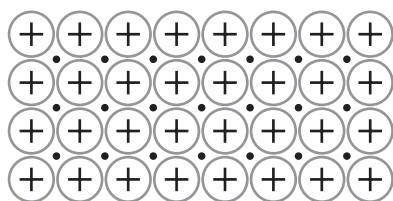
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(b) The diagram shows the arrangement of the particles in samarium.



Key

- $\oplus$ samarium ion
- electron

Explain why samarium is malleable and is a good conductor of electricity.

(4)

(Total for Question 10 = 7 marks)

TOTAL FOR PAPER = 60 MARKS



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