



# Cambridge IGCSE™ (9–1)

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## CHEMISTRY

0971/11

Paper 1 Multiple Choice (Core)

May/June 2024

45 minutes

You must answer on the multiple choice answer sheet.



You will need: Multiple choice answer sheet  
Soft clean eraser  
Soft pencil (type B or HB is recommended)

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### INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

### INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

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This document has **16** pages.

- 1 The boiling point of sodium is 890 °C.

What happens to sodium atoms as the temperature of a sample of sodium changes from 950 °C to 900 °C?

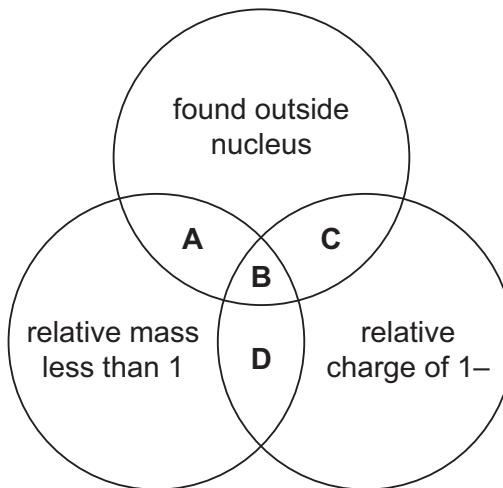
- A The atoms move more quickly and bonds are formed.
- B The atoms move more quickly and bonds are neither broken nor formed.
- C The atoms move more slowly and bonds are formed.
- D The atoms move more slowly and bonds are neither broken nor formed.

- 2 Which row shows the conditions for the particles of a gas colliding most frequently?

	pressure	temperature
A	high	high
B	high	low
C	low	high
D	low	low

- 3 The diagram shows some properties of particles in an atom.

To which labelled part of the diagram do electrons belong?



- 4 Some properties of substances W, X, Y and Z are shown.

	melting point / °C	electrical conductivity
W	801	conducts when molten
X	-182	does not conduct
Y	840	conducts when solid
Z	501	conducts when molten

Which substances are ionic?

- A** W, X and Y    **B** W and Y only    **C** W and Z    **D** X and Z

- 5 Atoms lose or gain electrons to become ions.

Which row is correct?

	change to the atom	type of ion	charge on ion
<b>A</b>	loss of two electrons	cation	2-
<b>B</b>	loss of one electron	anion	1-
<b>C</b>	gain of three electrons	anion	3-
<b>D</b>	gain of one electron	cation	1-

- 6 A covalent molecule, M, contains four shared pairs of electrons.

What is M?

- A** ammonia,  $\text{NH}_3$   
**B** hydrogen chloride,  $\text{HCl}$   
**C** methane,  $\text{CH}_4$   
**D** water,  $\text{H}_2\text{O}$

- 7 Which substance has a giant covalent structure?

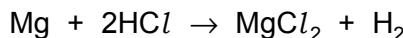
- A** sodium chloride  
**B** sodium  
**C** ethane  
**D** diamond

- 8 Iron(III) oxide is reduced by carbon monoxide to produce iron and carbon dioxide.

What is the balanced equation for this reaction?

- A**  $\text{Fe}_2\text{O}_3 + 2\text{CO} \rightarrow 2\text{Fe} + 2\text{CO}_2$
- B**  $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
- C**  $2\text{Fe}_2\text{O}_3 + 6\text{CO} \rightarrow 2\text{Fe} + 6\text{CO}_2$
- D**  $2\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 4\text{Fe} + 3\text{CO}_2$

- 9 The equation for the reaction between magnesium and dilute hydrochloric acid is shown.



Which mass of magnesium chloride is formed when 48.0 g of magnesium completely reacts with excess dilute hydrochloric acid?

- A** 23.8 g      **B** 47.5 g      **C** 95.0 g      **D** 190 g

- 10 Dilute sulfuric acid and lead(II) bromide are electrolysed separately.

Which statements are correct?

- 1 Colourless gases are produced when dilute sulfuric acid is electrolysed.
- 2 Lead(II) bromide can be electrolysed when molten.
- 3 Lead is formed at the positive electrode when lead(II) bromide is electrolysed.
- 4 Sulfate ions are produced at the negative electrode when dilute sulfuric acid is electrolysed.

- A** 1 and 2      **B** 1 and 3      **C** 2 and 3      **D** 3 and 4

- 11 Which statements about a hydrogen–oxygen fuel cell are correct?

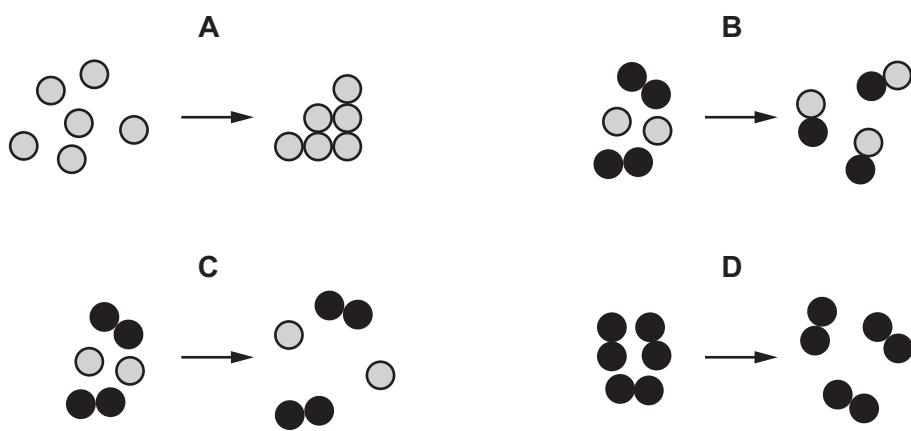
- 1 The main form of energy released by the fuel cell is heat.
- 2 The reaction is a redox reaction.
- 3 An acidic gas is produced.
- 4 Water is the only chemical product.

- A** 1 and 3      **B** 1 and 4      **C** 2 and 3      **D** 2 and 4

12 Which row describes what happens during an endothermic reaction?

	thermal energy is transferred	change in temperature of the reaction mixture
A	from the surroundings	decrease
B	from the surroundings	increase
C	to the surroundings	decrease
D	to the surroundings	increase

13 Which diagram represents a chemical change?



- 14 A method used to investigate the rate of reaction of calcium carbonate with dilute hydrochloric acid under different conditions is shown.

- Place 50 cm<sup>3</sup> of dilute hydrochloric acid in a conical flask.
- Add a known volume of water to the conical flask.
- Heat the conical flask to the required temperature.
- Add 1.0 g of calcium carbonate to the conical flask.
- Measure the time taken for the reaction to finish.

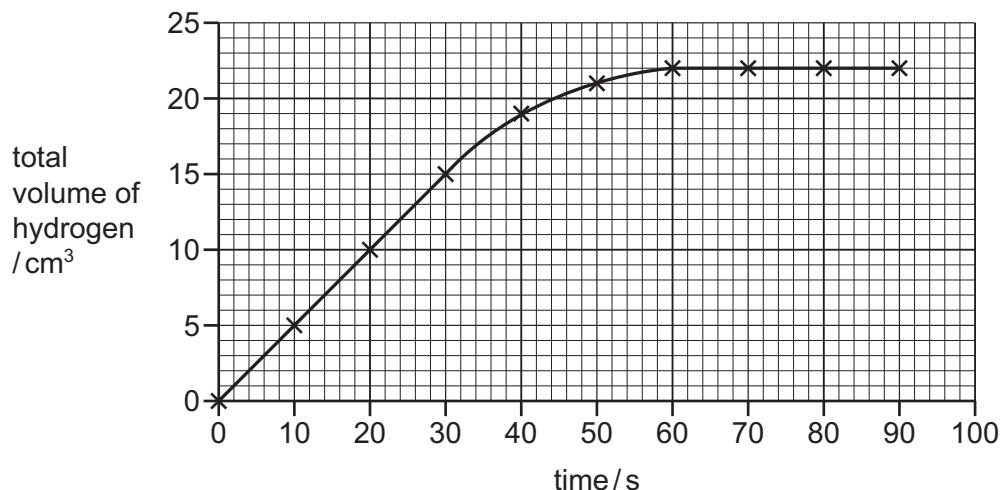
Which volume of water and which temperature give the shortest time taken for the reaction to finish?

	volume of water added / cm <sup>3</sup>	temperature / °C
<b>A</b>	10	30
<b>B</b>	10	50
<b>C</b>	40	30
<b>D</b>	40	50

- 15 The rate of reaction between magnesium and hydrochloric acid is investigated.

The total volume of hydrogen given off is measured at different times.

A graph of the results is shown.



Which conclusions are correct?

- 1 The rate is fastest between 0 and 30 seconds.
- 2 The maximum volume of hydrogen given off is 22 cm<sup>3</sup>.
- 3 At 40 seconds, 20 cm<sup>3</sup> of hydrogen is given off.

**A** 1 and 2 only    **B** 1 and 3 only    **C** 2 and 3 only    **D** 1, 2 and 3

- 16 Water is added to anhydrous copper(II) sulfate.

Which row describes the direction of energy change and the colour change of the mixture during the reaction?

	direction of energy change	colour change
<b>A</b>	absorbed from the surroundings	blue to white
<b>B</b>	absorbed from the surroundings	white to blue
<b>C</b>	released to the surroundings	blue to white
<b>D</b>	released to the surroundings	white to blue

17 Which equation represents an oxidation reaction?

- A  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
- B  $4\text{FeO} + \text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$
- C  $2\text{NO}_2 \rightarrow \text{N}_2\text{O}_4$
- D  $2\text{P}_2\text{O}_5 \rightarrow \text{P}_4\text{O}_{10}$

18 A farmer treats a field with calcium hydroxide to make it less acidic.

When the farmer adds ammonium nitrate fertiliser to the field immediately after the calcium hydroxide, the two substances react.

Why does this reaction make the fertiliser less effective?

- A It makes ammonia gas, so less nitrogen is absorbed by the soil.
- B It makes an acid, making the soil acidic again.
- C It makes nitrogen gas, so less nitrogen is absorbed by the soil.
- D It makes the fertiliser too strong, stopping the plants growing well.

19 Which statement about sodium oxide or nitrogen dioxide is correct?

- A Nitrogen dioxide is a solid at room temperature.
- B Nitrogen dioxide is acidic.
- C Sodium oxide has a lower melting point than nitrogen dioxide.
- D Sodium oxide is covalently bonded.

20 A titration method is used to prepare a pure soluble sulfate salt from dilute sulfuric acid.

What is the other reagent?

- A copper(II) oxide
- B magnesium
- C sodium hydroxide
- D zinc carbonate

21 Which row about elements in the Periodic Table is correct?

	statement 1	statement 2
<b>A</b>	two elements in the same group have similar chemical properties	metals are on the left of the table
<b>B</b>	two elements in the same group have similar chemical properties	metals are on the right of the table
<b>C</b>	two elements in the same period have similar chemical properties	metals are on the left of the table
<b>D</b>	two elements in the same period have similar chemical properties	metals are on the right of the table

22 The table gives some information about three elements in Group I of the Periodic Table.

element	atomic number	melting point in °C	density in g/cm <sup>3</sup>
lithium	3	181	0.53
sodium	11	98	0.97
rubidium	37	X	X

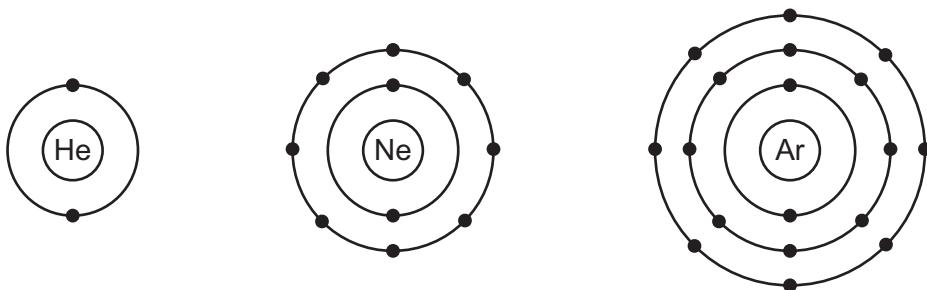
Which row identifies the melting point and the density of rubidium?

	melting point in °C	density in g/cm <sup>3</sup>
<b>A</b>	39	0.38
<b>B</b>	39	1.53
<b>C</b>	253	0.38
<b>D</b>	253	1.53

23 Which statement describes a transition element?

- A** It is a dull grey metal that only forms white compounds.
- B** It is a high-density metal with a high melting point that is used as a catalyst.
- C** It is a low-density metal with a high melting point that reacts with steam to make hydrogen.
- D** It is a soft, shiny silver metal that reacts vigorously with water.

- 24 The electronic configurations of helium, neon and argon are shown.



Which row describes these gases?

	reactivity	form of the gas	electronic configuration
A	reactive	monatomic	incomplete outer shell of electrons
B	unreactive	diatomic	complete outer shell of electrons
C	unreactive	diatomic	incomplete outer shell of electrons
D	unreactive	monatomic	complete outer shell of electrons

- 25 X is a shiny silver-coloured solid at room temperature and pressure.

X is a good conductor of heat and electricity when solid.

Which statement about X is correct?

- A X is an ionic compound or a metallic element.
- B X is a metallic element or a non-metallic element.
- C X is an alloy or a metallic element.
- D X is an alloy or a non-metallic element.

- 26 Which elements can be combined to produce an alloy?

- 1 magnesium and aluminium
- 2 nitrogen and oxygen
- 3 iron and carbon
- 4 copper and zinc

- A 1, 3 and 4
- B 1 and 2
- C 2 and 3
- D 4 only

- 27 Three metals, L, M and N, are added separately to dilute hydrochloric acid and cold water.

The results are shown.

metal	reaction with dilute hydrochloric acid	reaction with cold water
L	hydrogen forms	no reaction
M	hydrogen forms	hydrogen forms
N	no reaction	no reaction

What is the order of reactivity of the metals?

	least reactive	→		most reactive
<b>A</b>	L	N		M
<b>B</b>	M	L		N
<b>C</b>	N	L		M
<b>D</b>	N	M		L

- 28 Which reaction produces carbon dioxide?

- A** cracking of large hydrocarbon molecules
- B** photosynthesis
- C** reaction of a base with a carbonate
- D** thermal decomposition of calcium carbonate

- 29 A sample of air containing four gases only is analysed.

99.0% of the sample contains the two main gases in the same percentages as in clean, dry air.

The remaining 1.0% of the sample contains argon and carbon dioxide.

The gas that makes up 0.1% of the sample turns limewater milky.

Which row shows the percentage composition of the sample of air?

	99.0% of the sample	0.9% of the sample	0.1% of the sample
A	78.0% nitrogen, 21.0% oxygen	argon	carbon dioxide
B	78.0% nitrogen, 21.0% oxygen	carbon dioxide	argon
C	78.0% oxygen, 21.0% nitrogen	argon	carbon dioxide
D	78.0% oxygen, 21.0% nitrogen	carbon dioxide	argon

- 30 Which substance contains **two** elements that are found in NPK fertilisers?

- A ammonium chloride
- B calcium hydroxide
- C potassium nitrate
- D sodium phosphate

- 31 Which statement about sulfur is correct?

- A When sulfur is burned, it produces a substance that causes acid rain.
- B Sulfur is produced by the thermal decomposition of limestone.
- C Compounds of sulfur make up approximately 1% of unpolluted air.
- D Sulfur is a member of the family of elements called halogens.

- 32 What are **two** adverse effects of particulates in the air?

- 1 acid rain
- 2 cancer
- 3 photochemical smog
- 4 respiratory problems

- A 1 and 3
- B 1 and 4
- C 2 and 3
- D 2 and 4

33 Which formula represents a compound that is a member of the homologous series of alkanes?

- A**  $\text{C}_2\text{H}_4$       **B**  $\text{C}_3\text{H}_6$       **C**  $\text{C}_4\text{H}_8$       **D**  $\text{C}_5\text{H}_{12}$

34 Which statement about ethane is correct?

- A** It rapidly decolourises aqueous bromine.  
**B** It does **not** burn.  
**C** It forms long-chain compounds called polymers.  
**D** It only contains single bonds between its atoms.

35 Which raw material is used to make ethanol by fermentation?

- A** carbon dioxide  
**B** ethene  
**C** glucose  
**D** natural gas

36 Which statement about ethanoic acid is correct?

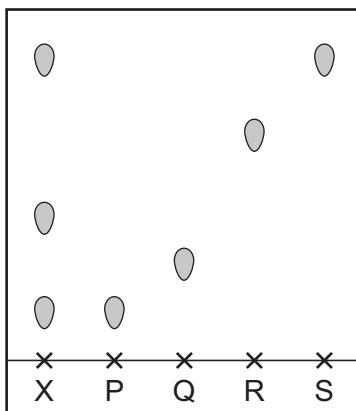
- A** It contains a  $-\text{COOH}$  group.  
**B** It has a pH greater than pH 7.  
**C** It reacts with sodium carbonate to form hydrogen gas.  
**D** It reacts with copper to form copper(II) ethanoate.

37 Which statement explains why the disposal of plastic waste leads to environmental problems?

- A** Plastic waste forms toxic gases when it is burned.  
**B** Plastic waste contains many small molecules.  
**C** Plastic waste rapidly dissolves in the oceans.  
**D** Plastic waste reacts with both acids and bases.

38 Substance X and four known substances, P, Q, R and S, are analysed by chromatography.

The chromatogram produced is shown.



Which statement about X is correct?

- A It is a mixture of P, Q and S.
- B It contains P and S only.
- C It contains P, S and another unknown substance.
- D It is a mixture of Q, R and S.

39 Copper is insoluble in water.

Copper(II) oxide is a solid that is insoluble in water but reacts with dilute hydrochloric acid.

Which method is used to separate copper from a mixture of copper and copper(II) oxide?

- A dissolve the mixture in water then filter
- B dissolve the mixture in water then crystallise
- C react the mixture with dilute hydrochloric acid then filter
- D react the mixture with dilute hydrochloric acid then crystallise

40 A salt, S, is dissolved in water and three tests are carried out on the solution formed.

	test	result
1	aqueous sodium hydroxide is added	green precipitate forms, insoluble in excess sodium hydroxide
2	dilute nitric acid is added	no reaction
3	aqueous barium nitrate is added to the solution from test 2	white precipitate forms

What is the identity of S?

- A copper(II) chloride
- B copper(II) sulfate
- C iron(II) chloride
- D iron(II) sulfate

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## The Periodic Table of Elements

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3	Li	4	Be	5	Li	6	Be	7	Li	8	Be	9	Li	10	Be	11	Li	12	Be	13	Li	14	Be	15	Li	16	Be	17	Li	18	Be	19	Li	20	Be	21	Li	22	Be	23	Li	24	Be	25	Li	26	Be	27	Li	28	Be	29	Li	30	Be	31	Li	32	Be	33	Li	34	Be	35	Li	36	Be	37	Li	38	Be	39	Li	40	Be	41	Li	42	Be	43	Li	44	Be	45	Li	46	Be	47	Li	48	Be	49	Li	50	Be	51	Li	52	Be	53	Li	54	Be	55	Li	56	Be	57	Li	58	Be	59	Li	60	Be	61	Li	62	Be	63	Li	64	Be	65	Li	66	Be	67	Li	68	Be	69	Li	70	Be	71	Li	72	Be	73	Li	74	Be	75	Li	76	Be	77	Li	78	Be	79	Li	80	Be	81	Li	82	Be	83	Li	84	Be	85	Li	86	Be	87	Li	88	Be	89	Li	90	Be	91	Li	92	Be	93	Li	94	Be	95	Li	96	Be	97	Li	98	Be	99	Li	100	Be	101	Li	102	Be	103	Li	104	Be	105	Li	106	Be	107	Li	108	Be	109	Li	110	Be	111	Li	112	Be	113	Li	114	Be	115	Li	116	Be	117	Li	118	Be	119	Li	120	Be	121	Li	122	Be	123	Li	124	Be	125	Li	126	Be	127	Li	128	Be	129	Li	130	Be	131	Li	132	Be	133	Li	134	Be	135	Li	136	Be	137	Li	138	Be	139	Li	140	Be	141	Li	142	Be	143	Li	144	Be	145	Li	146	Be	147	Li	148	Be	149	Li	150	Be	151	Li	152	Be	153	Li	154	Be	155	Li	156	Be	157	Li	158	Be	159	Li	160	Be	161	Li	162	Be	163	Li	164	Be	165	Li	166	Be	167	Li	168	Be	169	Li	170	Be	171	Li	172	Be	173	Li	174	Be	175	Li	176	Be	177	Li	178	Be	179	Li	180	Be	181	Li	182	Be	183	Li	184	Be	185	Li	186	Be	187	Li	188	Be	189	Li	190	Be	191	Li	192	Be	193	Li	194	Be	195	Li	196	Be	197	Li	198	Be	199	Li	200	Be	201	Li	202	Be	203	Li	204	Be	205	Li	206	Be	207	Li	208	Be	209	Li	210	Be	211	Li	212	Be	213	Li	214	Be	215	Li	216	Be	217	Li	218	Be	219	Li	220	Be	221	Li	222	Be	223	Li	224	Be	225	Li	226	Be	227	Li	228	Be	229	Li	230	Be	231	Li	232	Be	233	Li	234	Be	235	Li	236	Be	237	Li	238	Be	239	Li	240	Be	241	Li	242	Be	243	Li	244	Be	245	Li	246	Be	247	Li	248	Be	249	Li	250	Be	251	Li	252	Be	253	Li	254	Be	255	Li	256	Be	257	Li	258	Be	259	Li	260	Be	261	Li	262	Be	263	Li	264	Be	265	Li	266	Be	267	Li	268	Be	269	Li	270	Be	271	Li	272	Be	273	Li	274	Be	275	Li	276	Be	277	Li	278	Be	279	Li	280	Be	281	Li	282	Be	283	Li	284	Be	285	Li	286	Be	287	Li	288	Be	289	Li	290	Be	291	Li	292	Be	293	Li	294	Be	295	Li	296	Be	297	Li	298	Be	299	Li	300	Be	301	Li	302	Be	303	Li	304	Be	305	Li	306	Be	307	Li	308	Be	309	Li	310	Be	311	Li	312	Be	313	Li	314	Be	315	Li	316	Be	317	Li	318	Be	319	Li	320	Be	321	Li	322	Be	323	Li	324	Be	325	Li	326	Be	327	Li	328	Be	329	Li	330	Be	331	Li	332	Be	333	Li	334	Be	335	Li	336	Be	337	Li	338	Be	339	Li	340	Be	341	Li	342	Be	343	Li	344	Be	345	Li	346	Be	347	Li	348	Be	349	Li	350	Be	351	Li	352	Be	353	Li	354	Be	355	Li	356	Be	357	Li	358	Be	359	Li	360	Be	361	Li	362	Be	363	Li	364	Be	365	Li	366	Be	367	Li	368	Be	369	Li	370	Be	371	Li	372	Be	373	Li	374	Be	375	Li	376	Be	377	Li	378	Be	379	Li	380	Be	381	Li	382	Be	383	Li	384	Be	385	Li	386	Be	387	Li	388	Be	389	Li	390	Be	391	Li	392	Be	393	Li	394	Be	395	Li	396	Be	397	Li	398	Be	399	Li	400	Be	401	Li	402	Be	403	Li	404	Be	405	Li	406	Be	407	Li	408	Be	409	Li	410	Be	411	Li	412	Be	413	Li	414	Be	415	Li	416	Be	417	Li	418	Be	419	Li	420	Be	421	Li	422	Be	423	Li	424	Be	425	Li	426	Be	427	Li	428	Be	429	Li	430	Be	431	Li	432	Be	433	Li	434	Be	435	Li	436	Be	437	Li	438	Be	439	Li	440	Be	441	Li	442	Be	443	Li	444	Be	445	Li	446	Be	447	Li	448	Be	449	Li	450	Be	451	Li	452	Be	453	Li	454	Be	455	Li	456	Be	457	Li	458	Be	459	Li	460	Be	461	Li	462	Be	463	Li	464	Be	465	Li	466	Be	467	Li	468	Be	469	Li	470	Be	471	Li	472	Be	473	Li	474	Be	475	Li	476	Be	477	Li	478	Be	479	Li	480	Be	481	Li	482	Be	483	Li	484	Be	485	Li	486	Be	487	Li	488	Be	489	Li	490	Be	491	Li	492	Be	493	Li	494	Be	495	Li	496	Be	497	Li	498	Be	499	Li	500	Be	501	Li	502	Be	503	Li	504	Be	505	Li	506	Be	507	Li	508	Be	509	Li	510	Be	511	Li	512	Be	513	Li	514	Be	515	Li	516	Be	517	Li	518	Be	519	Li	520	Be	521	Li	522	Be	523	Li	524	Be	525	Li	526	Be	527	Li	528	Be	529	Li	530	Be	531	Li	532	Be	533	Li	534	Be	535	Li	536	Be	537	Li	538	Be	539	Li	540	Be	541	Li	542	Be	543	Li	544	Be	545	Li	546	Be	547	Li	548	Be	549	Li	550	Be	551	Li	552	Be	553	Li	554	Be	555	Li	556	Be	557	Li	558	Be	559	Li	560	Be	561	Li	562	Be	563	Li	564	Be	565	Li	566	Be	567	Li	568	Be	569	Li	570	Be	571	Li	572	Be	573	Li	574	Be	575	Li	576	Be	577	Li	578	Be	579	Li	580	Be	581	Li	582	Be	583	Li	584	Be	585	Li	586	Be	587	Li	588	Be	589	Li	590	Be	591	Li	592	Be	593	Li	594	Be	595	Li	596	Be	597	Li	598	Be	599	Li	600	Be	601	Li	602	Be	603	Li	604	Be	605	Li	606	Be	607	Li	608	Be	609	Li	610	Be	611	Li	612	Be	613	Li	614	Be	615	Li	616	Be	617	Li	618	Be	619	Li	620	Be	621	Li	622	Be	623	Li	624	Be	625	Li	626	Be	627	Li	628	Be	629	Li	630	Be	631	Li	632	Be	633	Li	634	Be	635	Li	636	Be	637	Li	638	Be	639	Li	640	Be	641	Li	642	Be	643	Li	644	Be	645	Li	646	Be	647	Li	648	Be	649	Li	650	Be	651	Li	652	Be	653	Li	654	Be	655	Li	656	Be	657	Li	658	Be	659	Li	660	Be	661	Li	662	Be	663	Li	664	Be	665	Li	666	Be	667	Li	668	Be	669	Li	670	Be	671	Li	672	Be	673	Li	674	Be	675	Li	676	Be	677	Li	678	Be	679	Li	680	Be	681	Li	682	Be	683	Li	684	Be	685	Li	686	Be</td