



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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NUMBER

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CHEMISTRY

0620/02

Paper 2

May/June 2008

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may need to use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES

Answer **all** questions.

A copy of the periodic table is printed on page 16.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

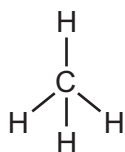
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This document consists of **16** printed pages.

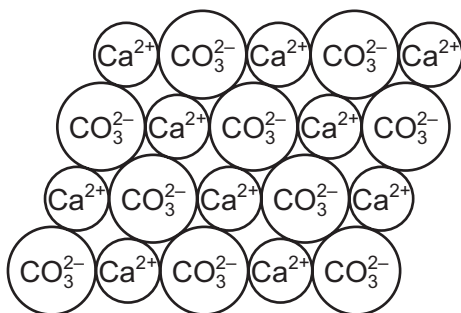


1 The diagram shows the structures of some substances containing carbon.

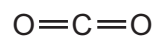
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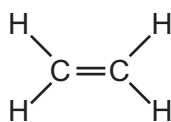
A



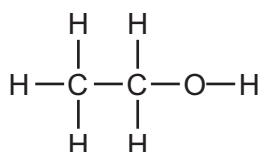
B



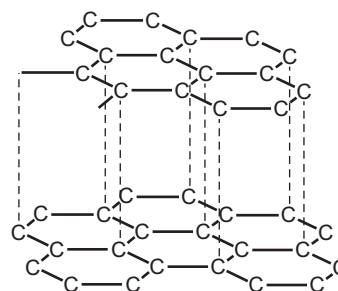
C



D



E



F

(a) Answer these questions using the letters **A, B, C, D, E** or **F**.

(i) Which one of these structures is ionic?

[1]

(ii) Which one of these structures represents ethanol?

[1]

(iii) Which one of these structures represents a gas which turns limewater milky?

[1]

(iv) Which one of these structures is an unsaturated hydrocarbon?

[1]

(b) Describe a chemical test for an unsaturated hydrocarbon.

test

result

[2]

(c) State the chemical name of structure **B**.

..... [1]

(d) Structure **F** has several uses. Which one of the following is a correct use of structure **F**?
Tick **one** box.

for cutting metals

as a lubricant

for filling balloons

as an insulator

[1]

(e) The structures **A** to **E** are compounds. What do you understand by the term *compound*?

.....
..... [1]

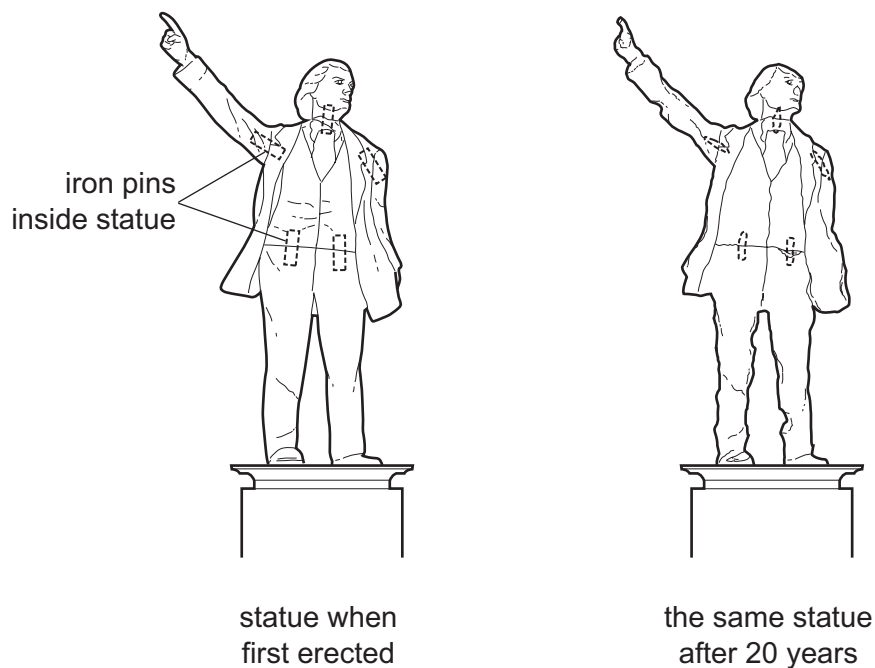
(f) State the type of bonding in structure **A**.

..... [1]

[Total: 10]

- 2 The diagram shows a statue in a park in an industrial town. The statue is made from limestone.

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- (a) State the name of the chemical present in limestone.

..... [1]

- (b) Use ideas about the chemistry of atmospheric pollutants to suggest how and why the statue changes over 20 years.

.....

 [4]

- (c) Parts of the statue are joined together with iron pins. After 30 years, the arm falls off the statue. Suggest why the arm falls off.

..... [1]

(d) Iron has several isotopes.

(i) What do you understand by the term *isotopes*?

..... [1]

(ii) The table shows the number of subatomic particles in an atom of iron.

type of particle	number of particles	relative charge on the particle
electron	26	
neutron	30	
proton	26	

Complete the table to show the relative charge on each particle. [3]

(iii) State the number of nucleons in this isotope of iron.

..... [1]

(e) Some isotopes are radioactive. State one industrial use of radioactive isotopes.

..... [1]

(f) Iron reacts with very dilute nitric acid.



Write a word equation for this reaction.

[1]

[Total: 13]

- 3 The table shows the concentration of some ions present in seawater.

name of ion	formula of ion	concentration of ion in g/dm ³
bromide	Br ⁻	0.07
calcium	Ca ²⁺	0.4
chloride	Cl ⁻	19.1
magnesium	Mg ²⁺	1.2
potassium	K ⁺	0.3
sodium	Na ⁺	10.6
	SO ₄ ²⁻	0.8

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- (a) Which negative ion has the highest concentration in seawater?

..... [1]

- (b) State the name of the ion with the formula SO₄²⁻.

..... [1]

- (c) Which two ions in the table are formed from Group I elements?

..... and [1]

- (d) When seawater is evaporated a number of different compounds are formed. State the name of the compound which is present in the greatest quantity.

..... [1]

- (e) State the names of two ions in the table which move to the cathode when seawater is electrolysed.

..... and [2]

(f) When concentrated seawater is electrolysed, chlorine is formed at one of the electrodes.

(i) To which Period in the Periodic Table does chlorine belong?

..... [1]

(ii) Draw the electronic structure of a chlorine molecule. Show only the outer electrons.

[2]

(g) Drinking water can be obtained by purifying seawater.

Explain why distillation rather than filtration is used to purify seawater for drinking.

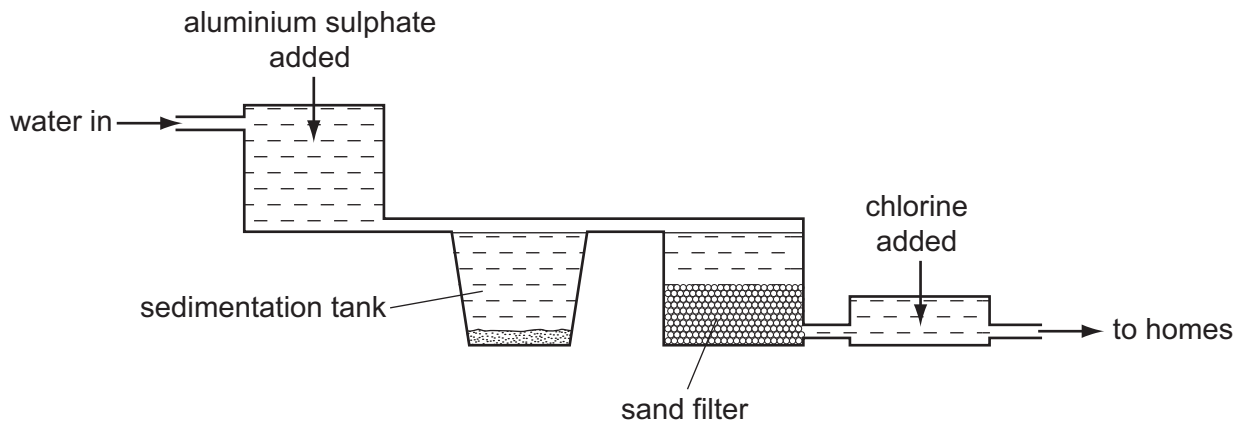
.....

..... [2]

[Total: 11]

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4 The diagram shows a water treatment works.



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Use

(a) State one use of water in industry.

..... [1]

(b) Explain how the sand filter helps purify the water.

.....
..... [2]

(c) The aluminium ions in aluminium sulphate cause clay particles to clump together. Describe a test for aluminium ions.

test

result

..... [3]

(d) Why is chlorine added to the water?

..... [1]

- (e) Chlorine is in Group VII of the Periodic Table.
When chlorine reacts with a solution of potassium bromide, the solution turns a reddish – brown colour.

For
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Use

- (i) Write a word equation for this reaction.

[2]

- (ii) Explain why iodine does not react with a solution of potassium bromide.

[1]

- (f) When chlorine reacts with sodium to form sodium chloride, energy is released.

- (i) State the name given to a reaction which releases energy.

[1]

- (ii) What type of bonding is present in sodium chloride?

[1]

- (iii) Explain what happens in terms of electron transfer when a sodium atom reacts with a chlorine atom.

[2]

[Total: 14]

5 Pure dry crystals of magnesium sulphate can be made by reacting excess magnesium powder with dilute sulphuric acid.

(a) During the reaction, bubbles of a colourless gas are given off.
State the name of this gas.

..... [1]

(b) (i) Why is excess magnesium used?

..... [1]

(ii) How is the excess magnesium removed from the reaction mixture?

..... [1]

(c) Describe how you can obtain pure dry crystals of magnesium sulphate from a solution of magnesium sulphate.

.....
..... [2]

(d) (i) Describe one other reaction that makes magnesium sulphate.

.....
..... [1]

(ii) Write a word equation for the reaction you suggested in part (d)(i).

[1]

(iii) Magnesium sulphate can be used as a medicine. Explain why the chemicals used in medicines need to be as pure as possible.

.....
..... [1]

- (e) A student repeats the experiment using excess sulphuric acid.
She obtains 24 g of magnesium sulphate from 4.8 g of magnesium.
How much magnesium sulphate can the student obtain from 1.2 g of magnesium?

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Use*

[1]

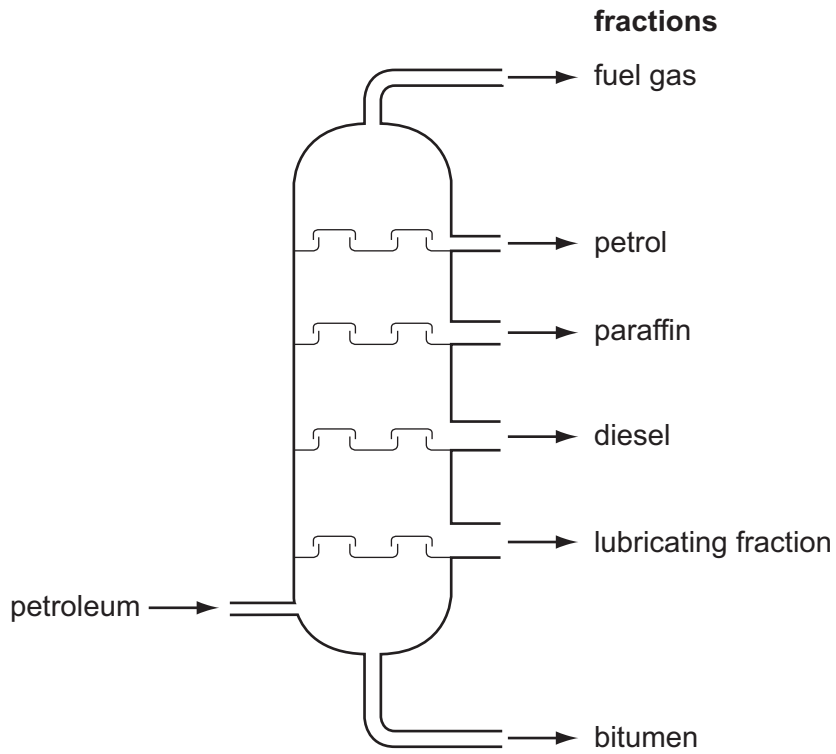
- (f) A sample of 20 g of impure magnesium sulphate contains 19.5 g of magnesium sulphate.
Calculate the percentage purity of the magnesium sulphate.

[1]

[Total: 10]

6 Petroleum is separated into useful fractions by distillation.

For
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Use



(a) (i) What do you understand by the term *fraction*?

.....
 [1]

(ii) Which fraction has the lowest boiling point?

..... [1]

(iii) Describe how distillation is used to separate these fractions.

.....

 [2]

(iv) State a use for

the paraffin fraction,

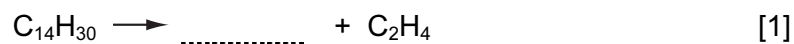
the bitumen fraction. [2]

(b) Ethene can be made by cracking certain hydrocarbon fractions.

(i) Explain what is meant by the term *cracking*.

.....
..... [1]

(ii) Complete the equation for the cracking of tetradecane, $C_{14}H_{30}$.



(c) Ethanol is formed when steam reacts with ethene at high pressure and temperature. A catalyst of phosphoric acid is used.



(i) What is the function of the catalyst?

..... [1]

(ii) What is the meaning of the symbol \rightleftharpoons ?

..... [1]

(iii) Ethanol is also formed when yeast grows in sugar solution.
What is this process called?
Put a ring around the correct answer.

addition **combustion** **fermentation** **neutralisation** [1]

(iv) Phosphoric acid is a typical acid. State what you would observe when a solution of phosphoric acid is added to

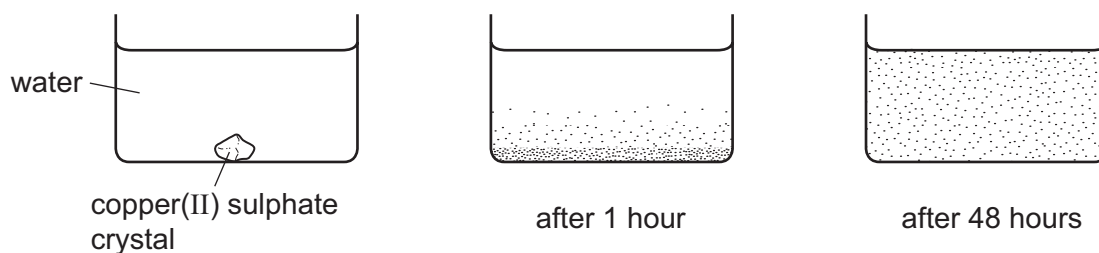
blue litmus,

a solution of sodium carbonate. [2]

[Total: 13]

- 7 A student placed a crystal of copper(II) sulphate in a beaker of water. After one hour the crystal had completely disappeared and a dense blue colour was observed in the water at the bottom of the beaker. After 48 hours the blue colour had spread throughout the water.

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Use



- (a) Use the kinetic particle theory to explain these observations.

.....

.....

.....

..... [2]

- (b) Describe the arrangement and motion of the particles in the copper(II) sulphate crystal.

arrangement

motion [2]

- (c) Copper ions can be separated from other metal ions by paper chromatography. Draw a labelled diagram of the apparatus for paper chromatography.

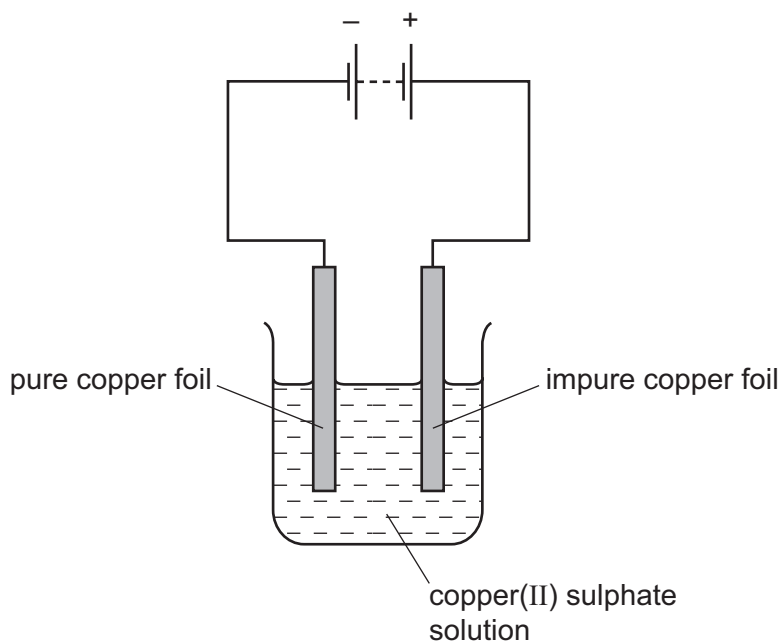
In your diagram include

- the solvent,
- the spot where the solution containing copper ions is placed.

[2]

(d) Copper can be purified by electrolysis.

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(i) Choose a word from the list below which describes the pure copper foil.
Put a ring around the correct answer.

anion **anode** **cathode** **cation** **electrolyte** [1]

(ii) Describe what happens during this electrolysis to

the pure copper foil,

the impure copper foil. [2]

[Total: 9]

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DATA SHEET
The Periodic Table of the Elements

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7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1	11 B Boron 5	12 C Carbon 6	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulphur 16	17 Cl Chlorine 17	18 Ar Argon 18	19 F Fluorine 9	20 Ne Neon 10	21 Na Sodium 11	22 Mg Magnesium 12	23 Al Aluminium 13	24 Si Silicon 14	25 P Phosphorus 15	26 S Sulphur 16	27 Cl Chlorine 17	28 Ar Argon 18	29 K Potassium 19	30 Ca Calcium 20	31 Sc Scandium 21	32 Ti Titanium 22	33 V Vanadium 23	34 Cr Chromium 24	35 Mn Manganese 25	36 Fe Iron 26	37 Co Cobalt 27	38 Ni Nickel 28	39 Cu Copper 29	40 Zn Zinc 30	41 Ga Gallium 31	42 Ge Germanium 32	43 As Arsenic 33	44 Se Selenium 34	45 Br Bromine 35	46 Kr Krypton 36	47 Rb Rubidium 37	48 Sr Strontium 38	49 Y Yttrium 39	50 Zr Zirconium 40	51 Nb Niobium 41	52 Mo Molybdenum 42	53 Tc Technetium 43	54 Ru Ruthenium 44	55 Rh Rhodium 45	56 Pd Palladium 46	57 Cd Cadmium 48	58 In Indium 49	59 Sn Tin 50	60 Sb Antimony 51	61 Te Tellurium 52	62 I Iodine 53	63 Xe Xenon 54	64 Cs Caesium 55	65 Ba Barium 56	66 La Lanthanum 57	67 Hf Hafnium 72	68 Ta Tantalum 73	69 W Tungsten 74	70 Re Rhenium 75	71 Os Osmium 76	72 Ir Iridium 77	73 Pt Platinum 78	74 Au Gold 79	75 Hg Mercury 80	76 Tl Thallium 81	77 Pb Lead 82	78 Bi Bismuth 83	79 Po Polonium 84	80 At Astatine 85	81 Rn Radon 86	82 Fr Francium 87	83 Ra Radium 88	84 Ac Actinium 89	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000

*58-71 Lanthanoid series
†90-103 Actinoid series

a	X	a = relative atomic mass
b	X	b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).