



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE  
NAME

CENTRE  
NUMBER

--	--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--

**PHYSICAL SCIENCE**

**0652/21**

Paper 2 (Core)

**October/November 2011**

**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 on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs, tables 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.

**For Examiner's Use**

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
<b>Total</b>	

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



- 1 A list of apparatus commonly found in the laboratory is shown below.

**balance                  beaker                  burette                  spatula                  thermometer**

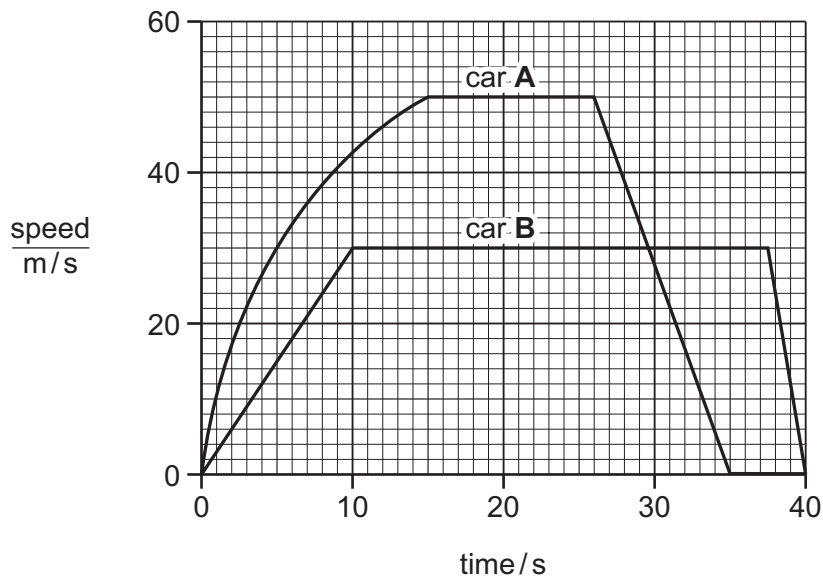
Choose the item from the list which you would use to carry out each of the following actions.

- (a) weigh 0.5 g of copper(II) carbonate .....
- (b) measure 25.0 cm<sup>3</sup> of water .....
- (c) find the temperature of boiling ethanol .....
- (d) react together an acid and an alkali .....

[4]

- 2 Two cars are being tested on a straight level track.

Fig. 2.1 shows the speed-time graphs for the two cars, each of mass 1500 kg.



**Fig. 2.1**

- (a) Determine the maximum speed of car A.

maximum speed = ..... m/s [1]

(b) Describe the motion of car **B** during the last 2.5 s of the test.

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

(c) Use the graph to determine the distance travelled by car **B** during the first 10 s of the test.

distance = ..... m [2]

(d) From 10.0 s to 37.5 s car **B** is travelling at constant speed in a straight line.

(i) State the resultant force on the car during this time.

force = ..... [1]

(ii) Explain why the car engine must continue to do work during this period.

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

(e) At the beginning of the test both cars accelerate from rest.

Explain which car produces the greater accelerating force.

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

3 (a) Give an example of an ionic compound and an example of a covalent compound.

ionic compound .....

covalent compound ..... [2]

(b) Describe **two** differences in the properties of ionic and covalent compounds.

1 .....

.....

2 .....

..... [2]

(c) Draw a dot and cross diagram to show the electron arrangement in an atom of magnesium.

[2]

4 (a) Name the main ore of aluminium.

..... [1]

(b) Explain why aluminium is not extracted from its ore by heating with carbon.

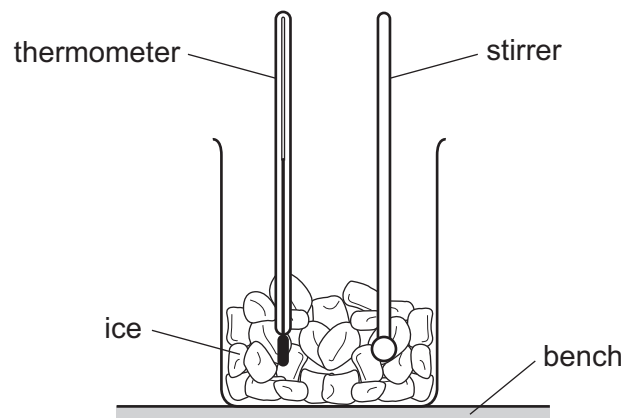
.....  
.....  
..... [2]

*For  
Examiner's  
Use*

- 5 A student is investigating the melting of fruit flavoured crushed ice. Initially, the temperature of the ice is  $-10^{\circ}\text{C}$ . He measures the temperature every 30 s.

For  
Examiner's  
Use

Fig. 5.1 shows the apparatus he uses.



**Fig. 5.1**

- (a) (i) Explain why the student stirs the crushed ice just before taking each temperature reading.

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

- (ii) Suggest why, in the first two minutes of the experiment, the temperature of the ice rises, even though there is no apparent heat source.

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

The graph in Fig. 5.2 shows how the temperature of the ice changes with time.

For  
Examiner's  
Use

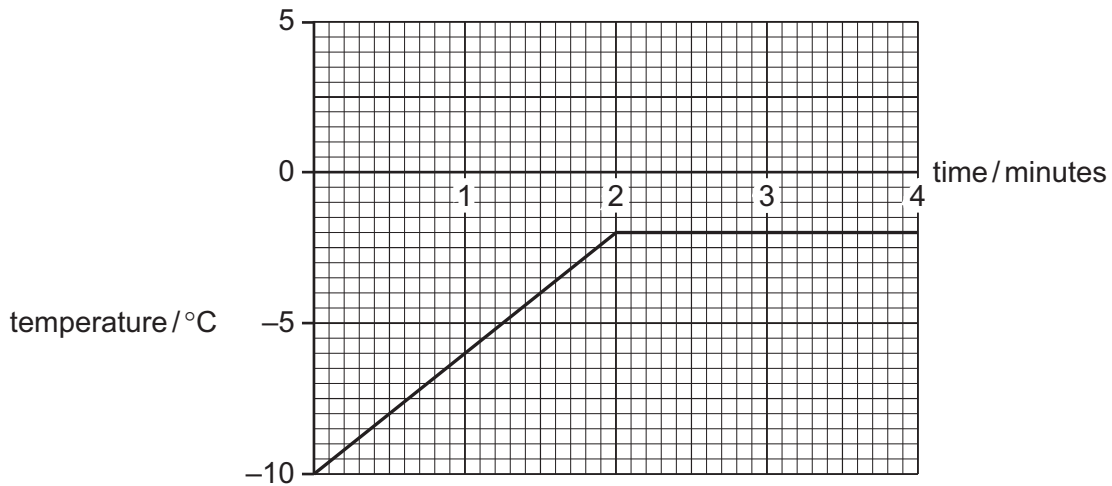


Fig. 5.2

(b) Determine the temperature at which this sample of ice melts.

temperature = ..... °C [1]

(c) Explain in terms of the kinetic theory what is happening to the sample from two minutes to four minutes.

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

- 6 (a) Complete Table 6.1 by putting in the missing names, formulae and molar masses.

Table 6.1

name	formula	mass of 1 mole / g
.....	H <sub>2</sub> O	.....
hydrogen chloride	.....	36.5
sodium fluoride	.....	42
.....	N <sub>2</sub>	.....

[4]

- (b) Give the symbols for the ions in sodium fluoride and the number of protons present in each ion.

sodium ion ..... number of protons .....

fluoride ion ..... number of protons ..... [2]

- 7 The radioactive isotope  $^{105}_{45}\text{Rh}$  decays by emitting a beta-particle ( $\beta$ -particle).

- (a) (i) State the number of protons in the nucleus of this isotope.

number of protons = ..... [1]

- (ii) Calculate the number of neutrons in the nucleus.

number of neutrons = ..... [1]

For  
Examiner's  
Use



(b) (i) What is a beta-particle?

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

(ii) Describe the changes in the nucleus when a beta-particle is emitted.

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

8 (a) Give an advantage and a disadvantage of using hydrogen as a fuel for motor vehicles.

advantage .....

disadvantage ..... [2]

(b) Write a balanced equation for the burning of hydrogen in air.

..... [2]

(c) Describe a test for hydrogen and state the expected result.

test .....

result ..... [2]

(d) The reaction between hydrogen and nitrogen is an important industrial process.

(i) Name the gas formed.

..... [1]

(ii) Name this industrial process.

..... [1]

- 9 A student experiments with a rubber band. She stretches it between two retort stands and notices that it produces a sound when she plucks it. The apparatus is shown in Fig. 9.1.

For  
Examiner's  
Use

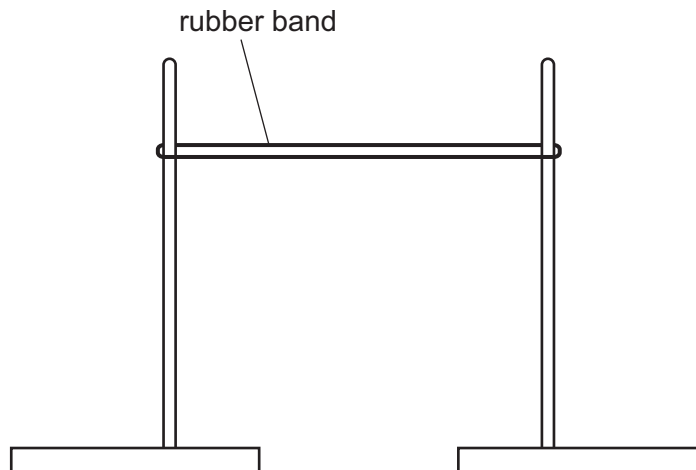


Fig. 9.1

- (a) Explain why the sound is produced.

.....

.....

..... [2]

- (b) The student sets up a cathode ray oscilloscope and a microphone as shown in Fig. 9.2 to display the sound trace produced by the apparatus in Fig. 9.1.

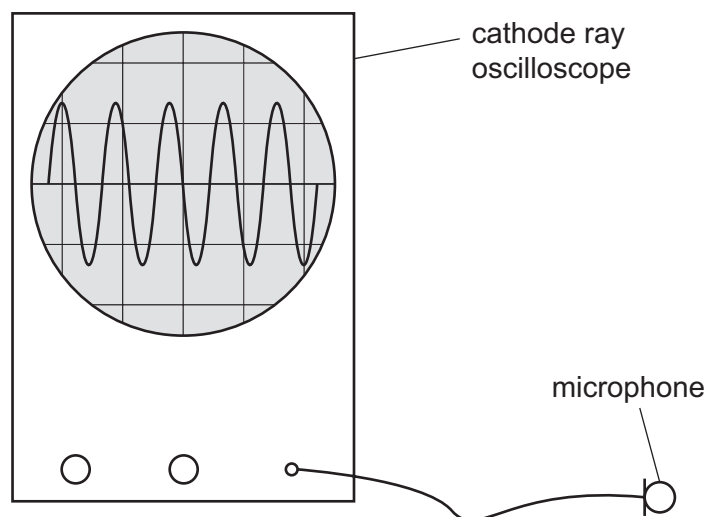
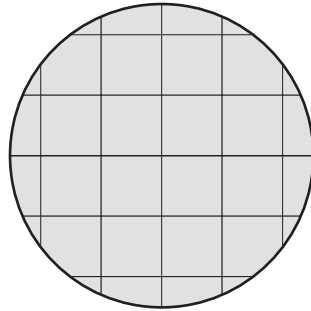


Fig. 9.2

- (i) She now plucks the rubber band so that a quieter note of the same frequency is heard.

For  
Examiner's  
Use

Draw, on Fig. 9.3, the trace that is now seen.



[2]

Fig. 9.3

- (ii) She moves the stands further apart. She plucks the band again. The frequency of the sound now heard is greater than before.

Explain what is meant by the term *frequency* and state the unit used to measure it.

.....

.....

unit ..... [2]

10 Chlorine is in Group VII of the Periodic Table.

(a) Name this Group.

..... [1]

(b) Name another element in this Group.

..... [1]

(c) State **one** use of chlorine.

..... [1]

(d) Name the Group II element which is in the same period as chlorine.

..... [1]

(e) Describe how, using chlorine, you can show that a solution contains bromide ions.

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

(f) Write down the number of electrons in a bromine atom and in a bromide ion.

bromine atom .....

bromide ion ..... [2]

For  
Examiner's  
Use

11 Fig. 11.1 shows an electric circuit. The e.m.f. of the battery is 9.0 V.

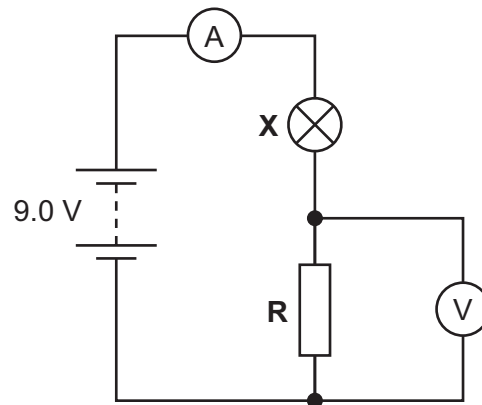


Fig. 11.1

For  
Examiner's  
Use

(a) Name component **X**. ..... [1]

(b) The resistance of resistor **R** is  $12\ \Omega$  and the resistance of component **X** is  $8.0\ \Omega$ .

(i) Calculate the combined resistance of **R** and **X**.

resistance = .....  $\Omega$  [1]

(ii) Calculate the current measured by the ammeter.

current = ..... [2]

(iii) Calculate the reading on the voltmeter.

reading = ..... V [2]

12 Methane and ethane are hydrocarbons. They are members of the same homologous series.

For  
Examiner's  
Use

(a) Name this homologous series.

..... [1]

(b) Give the name and formula of the next member of this series.

name .....

formula ..... [2]

(c) Explain why ethanol,  $C_2H_5OH$ , is not a hydrocarbon.

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

- 13 (a) Fig. 13.1 shows a stiff copper rod suspended between two magnetic poles. The copper rod is freely hinged at the top.

For  
Examiner's  
Use

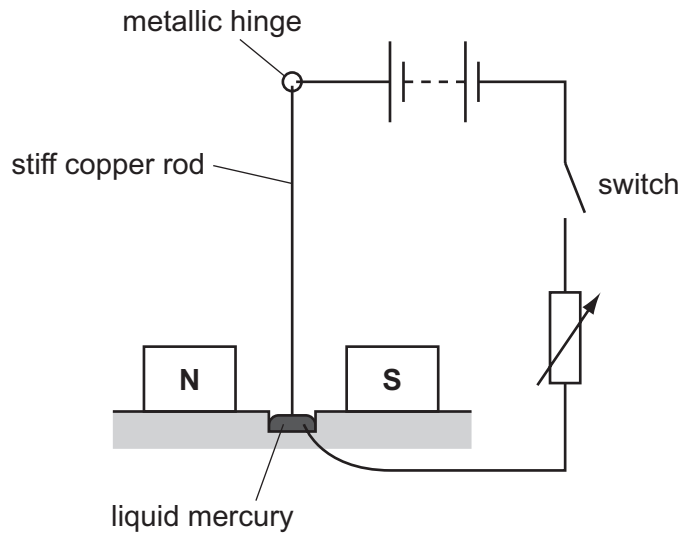


Fig. 13.1

- (a) Draw, on Fig. 13.1, the magnetic field between the poles. [3]

- (b) Explain why a current passes through the circuit when the switch is closed.  
 .....  
 .....  
 ..... [2]

- (c) State what will be observed when switch is closed.  
 .....  
 .....  
 ..... [2]

- (d) The connections to the battery are reversed so that the current in the circuit is in the opposite direction.  
 State how the observations change.  
 .....  
 ..... [1]

**DATA SHEET**  
**The Periodic Table of the Elements**

		Group																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
		I	II	III	IV	V	VI	VII	VIII	IX	X																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
		1 <b>H</b> Hydrogen 1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
		4 <b>He</b> Helium 2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7	9	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
<b>Li</b> Lithium	<b>Be</b> Beryllium	<b>B</b> Boron	<b>C</b> Carbon	<b>N</b> Nitrogen	<b>O</b> Oxygen	<b>F</b> Fluorine	<b>Ne</b> Neon	<b>Na</b> Sodium	<b>Mg</b> Magnesium	<b>Al</b> Aluminium	<b>Si</b> Silicon	<b>P</b> Phosphorus	<b>S</b> Sulfur	<b>Cl</b> Chlorine	<b>Ar</b> Argon	<b>K</b> Potassium	<b>Ca</b> Calcium	<b>Sc</b> Scandium	<b>Ti</b> Titanium	<b>V</b> Vanadium	<b>Cr</b> Chromium	<b>Mn</b> Manganese	<b>Fe</b> Iron	<b>Co</b> Cobalt	<b>Ni</b> Nickel	<b>Cu</b> Copper	<b>Zn</b> Zinc	<b>Ga</b> Gallium	<b>Ge</b> Germanium	<b>As</b> Arsenic	<b>Se</b> Selenium	<b>Br</b> Bromine	<b>Kr</b> Krypton																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
19	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
<b>Rb</b> Rubidium	<b>Sr</b> Strontium	<b>Y</b> Yttrium	<b>Zr</b> Zirconium	<b>Nb</b> Niobium	<b>Mo</b> Molybdenum	<b>Tc</b> Technetium	<b>Ru</b> Ruthenium	<b>Rh</b> Rhodium	<b>Pd</b> Palladium	<b>Ag</b> Silver	<b>Cd</b> Cadmium	<b>In</b> Indium	<b>Sn</b> Tin	<b>Sb</b> Antimony	<b>Te</b> Tellurium	<b>I</b> Iodine	<b>Xe</b> Xenon	<b>Cs</b> Caesium	<b>Ba</b> Barium	<b>La</b> Lanthanum	<b>Ce</b> Cerium	<b>Pr</b> Praseodymium	<b>Nd</b> Neodymium	<b>Pm</b> Promethium	<b>Sm</b> Samarium	<b>Eu</b> Europium	<b>Gd</b> Gadolinium	<b>Tb</b> Terbium	<b>Dy</b> Dysprosium	<b>Ho</b> Holmium	<b>Er</b> Erbium	<b>Tm</b> Thulium	<b>Yb</b> Ytterbium	<b>Lu</b> Lutetium	<b>Fr</b> Francium	<b>Ra</b> Radium	<b>Ac</b> Actinium	<b>Th</b> Thorium	<b>Pa</b> Protactinium	<b>U</b> Uranium	<b>Np</b> Neptunium	<b>Pu</b> Plutonium	<b>Am</b> Americium	<b>Cm</b> Curium	<b>Bk</b> Berkelium	<b>Cf</b> Californium	<b>Es</b> Einsteinium	<b>Fm</b> Fermium	<b>Md</b> Mendelevium	<b>No</b> Nobelium	<b>Lr</b> Lawrencium																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
55	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

Key  

a	<b>X</b>
b	

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

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.