



# Cambridge IGCSE™

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## CHEMISTRY

0620/32

Paper 3 Theory (Core)

May/June 2025

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

### INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

### INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].
- The Periodic Table is printed in the question paper.

This document has **20** pages. Any blank pages are indicated.

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2

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1 A list of substances is shown.

aluminium  
bromine  
calcium  
carbon dioxide  
iron  
magnesium  
magnesium oxide  
neon  
oxygen  
potassium  
sulfur dioxide

Answer the following questions about these substances. Each substance may be used once, more than once or not at all.

State which substance is:

(a) an element which forms an ion with a 2– charge

..... [1]

(b) an ionic compound

..... [1]

(c) used as a catalyst

..... [1]

(d) approximately 21% of clean, dry air

..... [1]

(e) a gas needed for photosynthesis

..... [1]

(f) the most reactive metal in the list

..... [1]

(g) a gas that is tested for using acidified aqueous potassium manganate(VII)

..... [1]

(h) a noble gas

..... [1]

(i) in Group VII.

..... [1]

[Total: 9]

[Turn over]





2 This question is about sea water and the substances found in sea water.

(a) Table 2.1 shows the masses of some of the compounds formed when  $500\text{ cm}^3$  of sea water is evaporated.

**Table 2.1**

compound	formula	mass of compound/g
sodium chloride	$\text{NaCl}$	7.0
	$\text{MgSO}_4$	2.5
potassium bromide	$\text{KBr}$	1.5
calcium carbonate	$\text{CaCO}_3$	1.0

Answer these questions using the information from Table 2.1.

(i) State the chemical name of  $\text{MgSO}_4$ .

..... [1]

(ii) The total mass of compounds formed from  $500\text{ cm}^3$  of sea water is 12.0 g.

Calculate the total mass of compounds formed from  $750\text{ cm}^3$  of sea water.

mass = ..... g [1]

(iii) State which compound in Table 2.1 reacts with an acid to produce carbon dioxide.

..... [1]

(b) Potassium bromide is found in sea water and contains bromide ions.

Describe a test for bromide ions.

test .....

.....

observations .....

.....

[2]





(c) Calcium ions are in sea water.

Complete Fig. 2.1 to show:

- the electronic configuration of a calcium ion
- the charge on the ion.

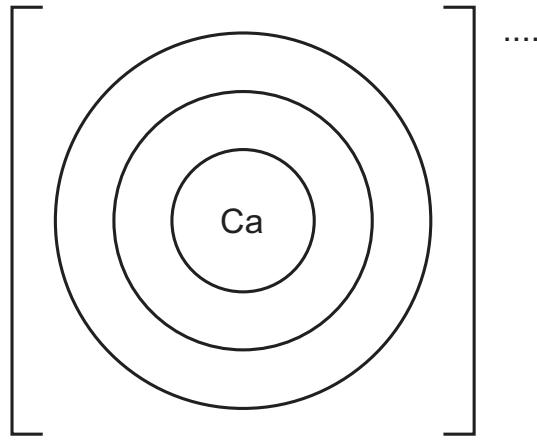


Fig. 2.1

[2]

(d) Sodium chloride is a solid at room temperature.

Describe the arrangement and motion of the particles in a solid.

arrangement .....

.....

motion .....

.....

[2]

(e) Sea water contains dissolved nitrate ions.

State **one** source of nitrate ions.

..... [1]

[Total: 10]





3 This question is about phosphorus and its compounds.

(a) (i) Phosphorus is in Group V of the Periodic Table.

Explain why phosphorus is placed in this group.

.....  
.....

[1]

(ii) Two isotopes of phosphorus are shown in Fig. 3.1.



**Fig. 3.1**

Complete Table 3.1 to show the number of protons, neutrons and electrons in one atom of these isotopes.

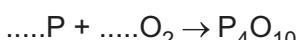
**Table 3.1**

	protons	neutrons	electrons
$^{31}_{15}\text{P}$			
$^{32}_{15}\text{P}$			

[3]

(iii) Phosphorus burns in oxygen to produce phosphorus(V) oxide.

Complete the symbol equation for this reaction.



[2]

(iv) State whether phosphorus(V) oxide is an acidic oxide or a basic oxide.

Give a reason for your answer.

.....  
.....

[1]





(b) (i) Phosphorus is one element in NPK fertilisers.

Draw a circle around **one other** element that is also in NPK fertilisers.

krypton

nickel

platinum

potassium

[1]

(ii) State why farmers use fertilisers on fields where crops are grown.

..... [1]

(c) A compound of phosphorus has the formula  $\text{Ca}_3(\text{PO}_4)_2$ .

Complete Table 3.2 to calculate the relative formula mass of  $\text{Ca}_3(\text{PO}_4)_2$ .

**Table 3.2**

atom	number of atoms	relative atomic mass	
oxygen	8	16	$8 \times 16 = 128$
calcium		40	
phosphorus		31	

relative formula mass = .....

[2]

[Total: 11]







**(b)** Ethanol is an organic molecule.

(i) Draw the displayed formula of a molecule of ethanol.

[2]

(ii) Ethanol is manufactured by the reaction of steam with ethene.

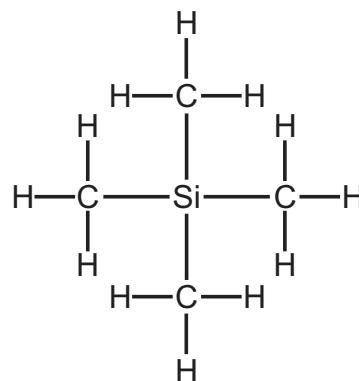
State **two** conditions for this process.

1 .....

2 .....

[2]

**(c)** Fig. 4.1 shows the displayed formula of tetramethylsilane.



**Fig. 4.1**

(i) Deduce the molecular formula of tetramethylsilane.

..... [1]

(ii) Name the **two** elements in tetramethylsilane that are in the same group in the Periodic Table.

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

[Total: 13]

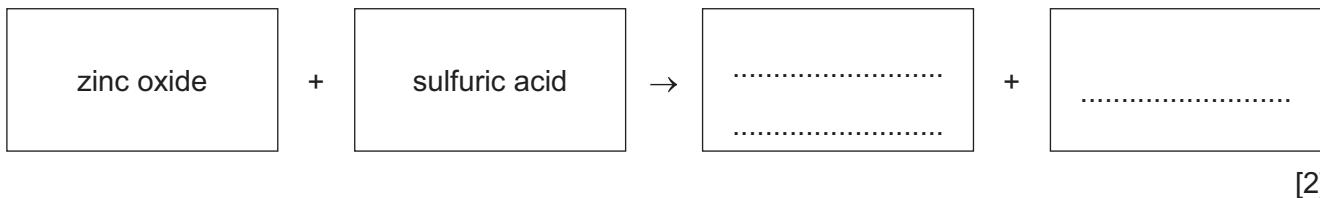




5 This question is about zinc salts.

(a) Excess solid zinc oxide is added to dilute sulfuric acid to produce a salt.

(i) Complete the word equation for this reaction.



(ii) Name the method used to remove excess solid zinc oxide from the reaction mixture.

..... [1]

(iii) Describe how crystals of the pure salt are made from an aqueous solution of the salt formed.

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

(b) Fig. 5.1 shows the apparatus for the electrolysis of molten zinc chloride using inert electrodes.

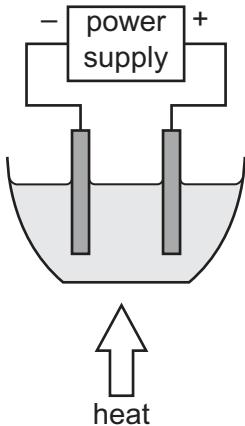


Fig. 5.1

(i) Label Fig. 5.1 to show the:

- cathode
- electrolyte.

[2]





(ii) Name a suitable material for the inert electrodes.

..... [1]

(iii) Name the products formed at the positive and negative electrodes.

positive electrode .....

negative electrode .....

[2]

(c) Zinc chloride has ionic bonds.

State the meaning of the term ionic bond.

.....

..... [2]

[Total: 12]





6 This question is about metals.

(a) (i) A student investigates the reaction of four different metals, **A**, **B**, **C** and **D**, with dilute hydrochloric acid.

All other conditions are the same in each test-tube.

The results of the experiment are shown in Fig. 6.1.

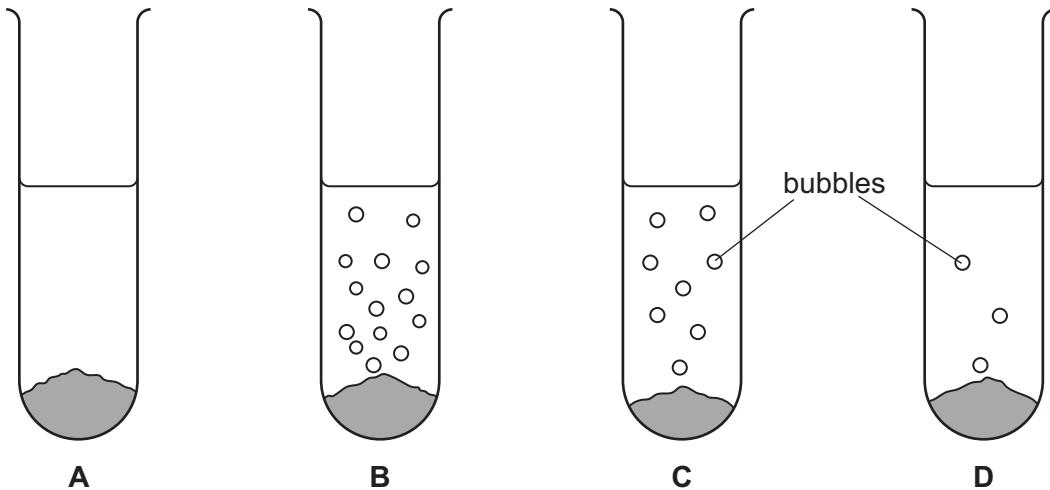


Fig. 6.1

Put the metals, **A**, **B**, **C** and **D**, in order of their reactivity.

most reactive .....

.....

.....

least reactive .....

[1]

(ii) The student wants to decrease the rate of the reaction in the experiment.

State **two** ways to decrease the rate of this reaction.

1 .....

2 .....

[2]

(b) In another experiment, a student adds potassium carbonate to dilute hydrochloric acid.

State the colour seen in the flame test for potassium ions.

..... [1]





(c) Brass is a mixture of two metals.

(i) State the name given to a mixture of metals such as brass.

..... [1]

(ii) Name the **two** metals in brass.

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

(iii) Magnalium is a mixture of magnesium and aluminium.

Suggest **one** property of magnalium that makes it more useful than pure magnesium metal.

..... [1]

[Total: 8]





7 (a) Select **two** processes that show a chemical change.

Tick (✓) **two** boxes.

boiling water

burning methane

dissolving salt

mixing ink and water

rusting of iron

[2]

(b) The reaction of hydrogen with nitrogen is a reversible reaction.

Write the symbol that shows a reversible reaction.

..... [1]

(c) Table 7.1 shows the results of four experiments.

**Table 7.1**

experiment	initial temperature/°C	final temperature/°C
1	18	23
2	19	17
3	18	14
4	19	29

(i) State which experiment shows the greatest temperature change.

..... [1]

(ii) State which experiment is the most endothermic.

..... [1]

(iii) In experiment 4, magnesium was added to dilute hydrochloric acid.

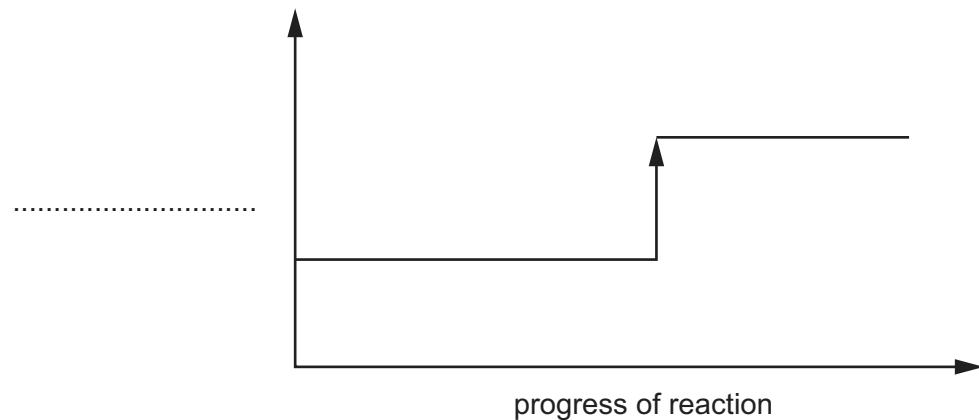
Complete the symbol equation.



[2]



(iv) Fig. 7.1 shows an incomplete reaction pathway diagram for an endothermic reaction.



**Fig. 7.1**

Complete Fig. 7.1 by labelling:

- the vertical axis
- the reactants
- the products.

[2]

[Total: 9]





8 This question is about water and air.

(a) Water needs to be treated to make it safe to drink.

Draw a line from each stage in the treatment of domestic water to the reason why it is carried out.

stage	reason
addition of carbon	to kill microbes
sedimentation	to remove tastes and odours
chlorination	to remove solids

[2]

(b) Describe how to test whether a sample of water is pure using melting point.

.....  
.....  
.....

[2]

(c) Air may contain sulfur dioxide and particulates.

(i) State **one** harmful effect of each of these air pollutants.

sulfur dioxide .....

particulates .....

[2]

(ii) Describe how flue gas desulfurisation reduces emissions of sulfur dioxide gas.

.....  
.....  
.....

[2]

[Total: 8]





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## The Periodic Table of Elements

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19	K potassium 39	20	Ca calcium 40	21	Sc scandium 45	22	Ti titanium 48	23	V vanadium 51	24	Cr chromium 52	25	Mn manganese 55	26	Fe iron 56	27	Co cobalt 59	28	Ni nickel 59	29	Cu copper 64	30	Zn zinc 65	31	Ga gallium 70	32	Ge germanium 73	33	As arsenic 75	34	Se selenium 79	35	Br bromine 80	36	Kr krypton 84	37	Rb rubidium 85	38	Sr strontium 88	39	Y yttrium 89	40	Zr zirconium 91	41	Nb niobium 93	42	Mo molybdenum 96	43	Tc technetium –	44	Ru ruthenium 101	45	Pd palladium 106	46	Ag silver 108	47	Cd cadmium 112	48	In indium 115	49	Sn tin 119	50	Sb antimony 122	51	Te tellurium 128	52	I iodine 127	53	Xe xenon 131	55	Cs caesium 133	56	Ba barium 137	57–71	Hf lanthanoids 178	72	Ta tantalum 181	73	W tungsten 184	74	Re rhenium 186	75	Os osmium 190	76	Ir iridium 192	77	Pt platinum 195	78	Au gold 197	79	Hg mercury 201	80	Tl thallium 204	81	Pb lead 207	82	Bi bismuth 209	83	Po polonium –	84	At astatine –	85	Rn radon –	87	Fr francium –	88	Ra radium –	89–103	Rf actinoids –	104	Db dubnium –	105	Bh bohrium –	106	Sg seaborgium –	107	Mt meitnerium –	108	Ds darmstadtium –	109	Rg rutherfordium –	110	Cn copernicium –	111	Nh nihonium –	112	Fl fermium –	113	Mc moscovium –	114	Fl fermium –	115	Lv livmorium –	116	Ts tennessine –	117	Og oganesson –	120	Lu lutetium –	121	Yb ytterbium –	122	Tm thulium –	123	Er erbium –	124	Dy dysprosium –	125	Tb terbium –	126	Gd gadolinium –	127	Ho holmium –	128	Er erbium –	129	Lu lutetium –	130	Yb ytterbium –	131	Tm thulium –	132	Er erbium –	133	Lu lutetium –	134	Yb ytterbium –	135	Tm thulium –	136	Er erbium –	137	Lu lutetium –	138	Yb ytterbium –	139	Tm thulium –	140	Er erbium –	141	Lu lutetium –	142	Yb ytterbium –	143	Tm thulium –	144	Er erbium –	145	Lu lutetium –	146	Yb ytterbium –	147	Tm thulium –	148	Er erbium –	149	Lu lutetium –	150	Yb ytterbium –	151	Tm thulium –	152	Er erbium –	153	Lu lutetium –	154	Yb ytterbium –	155	Tm thulium –	156	Er erbium –	157	Lu lutetium –	158	Yb ytterbium –	159	Tm thulium –	160	Er erbium –	161	Lu lutetium –	162	Yb ytterbium –	163	Tm thulium –	164	Er erbium –	165	Lu lutetium –	166	Yb ytterbium –	167	Tm thulium –	168	Er erbium –	169	Lu lutetium –	170	Yb ytterbium –	171	Tm thulium –	172	Er erbium –	173	Lu lutetium –	174	Yb ytterbium –	175	Tm thulium –	176	Er erbium –	177	Lu lutetium –	178	Yb ytterbium –	179	Tm thulium –	180	Er erbium –	181	Lu lutetium –	182	Yb ytterbium –	183	Tm thulium –	184	Er erbium –	185	Lu lutetium –	186	Yb ytterbium –	187	Tm thulium –	188	Er erbium –	189	Lu lutetium –	190	Yb ytterbium –	191	Tm thulium –	192	Er erbium –	193	Lu lutetium –	194	Yb ytterbium –	195	Tm thulium –	196	Er erbium –	197	Lu lutetium –	198	Yb ytterbium –	199	Tm thulium –	200	Er erbium –	201	Lu lutetium –	202	Yb ytterbium –	203	Tm thulium –	204	Er erbium –	205	Lu lutetium –	206	Yb ytterbium –	207	Tm thulium –	208	Er erbium –	209	Lu lutetium –	210	Yb ytterbium –	211	Tm thulium –	212	Er erbium –	213	Lu lutetium –	214	Yb ytterbium –	215	Tm thulium –	216	Er erbium –	217	Lu lutetium –	218	Yb ytterbium –	219	Tm thulium –	220	Er erbium –	221	Lu lutetium –	222	Yb ytterbium –	223	Tm thulium –	224	Er erbium –	225	Lu lutetium –	226	Yb ytterbium –	227	Tm thulium –	228	Er erbium –	229	Lu lutetium –	230	Yb ytterbium –	231	Tm thulium –	232	Er erbium –	233	Lu lutetium –	234	Yb ytterbium –	235	Tm thulium –	236	Er erbium –	237	Lu lutetium –	238	Yb ytterbium –	239	Tm thulium –	240	Er erbium –	241	Lu lutetium –	242	Yb ytterbium –	243	Tm thulium –	244	Er erbium –	245	Lu lutetium –	246	Yb ytterbium –	247	Tm thulium –	248	Er erbium –	249	Lu lutetium –	250	Yb ytterbium –	251	Tm thulium –	252	Er erbium –	253	Lu lutetium –	254	Yb ytterbium –	255	Tm thulium –	256	Er erbium –	257	Lu lutetium –	258	Yb ytterbium –	259	Tm thulium –	260	Er erbium –	261	Lu lutetium –	262	Yb ytterbium –	263	Tm thulium –	264	Er erbium –	265	Lu lutetium –	266	Yb ytterbium –	267	Tm thulium –	268	Er erbium –	269	Lu lutetium –	270	Yb ytterbium –	271	Tm thulium –	272	Er erbium –	273	Lu lutetium –	274	Yb ytterbium –	275	Tm thulium –	276	Er erbium –	277	Lu lutetium –	278	Yb ytterbium –	279	Tm thulium –	280	Er erbium –	281	Lu lutetium –	282	Yb ytterbium –	283	Tm thulium –	284	Er erbium –	285	Lu lutetium –	286	Yb ytterbium –	287	Tm thulium –	288	Er erbium –	289	Lu lutetium –	290	Yb ytterbium –	291	Tm thulium –	292	Er erbium –	293	Lu lutetium –	294	Yb ytterbium –	295	Tm thulium –	296	Er erbium –	297	Lu lutetium –	298	Yb ytterbium –	299	Tm thulium –	300	Er erbium –	301	Lu lutetium –	302	Yb ytterbium –	303	Tm thulium –	304	Er erbium –	305	Lu lutetium –	306	Yb ytterbium –	307	Tm thulium –	308	Er erbium –	309	Lu lutetium –	310	Yb ytterbium –	311	Tm thulium –	312	Er erbium –	313	Lu lutetium –	314	Yb ytterbium –	315	Tm thulium –	316	Er erbium –	317	Lu lutetium –	318	Yb ytterbium –	319	Tm thulium –	320	Er erbium –	321	Lu lutetium –	322	Yb ytterbium –	323	Tm thulium –	324	Er erbium –	325	Lu lutetium –	326	Yb ytterbium –	327	Tm thulium –	328	Er erbium –	329	Lu lutetium –	330	Yb ytterbium –	331	Tm thulium –	332	Er erbium –	333	Lu lutetium –	334	Yb ytterbium –	335	Tm thulium –	336	Er erbium –	337	Lu lutetium –	338	Yb ytterbium –	339	Tm thulium –	340	Er erbium –	341	Lu lutetium –	342	Yb ytterbium –	343	Tm thulium –	344	Er erbium –	345	Lu lutetium –	346	Yb ytterbium –	347	Tm thulium –	348	Er erbium –	349	Lu lutetium –	350	Yb ytterbium –	351	Tm thulium –	352	Er erbium –	353	Lu lutetium –	354	Yb ytterbium –	355	Tm thulium –	356	Er erbium –	357	Lu lutetium –	358	Yb ytterbium –	359	Tm thulium –	360	Er erbium –	361	Lu lutetium –	362	Yb ytterbium –	363	Tm thulium –	364	Er erbium –	365	Lu lutetium –	366	Yb ytterbium –	367	Tm thulium –	368	Er erbium –	369	Lu lutetium –	370	Yb ytterbium –	371	Tm thulium –	372	Er erbium –	373	Lu lutetium –	374	Yb ytterbium –	375	Tm thulium –	376	Er erbium –	377	Lu lutetium –	378	Yb ytterbium –	379	Tm thulium –	380	Er erbium –	381	Lu lutetium –	382	Yb ytterbium –	383	Tm thulium –	384	Er erbium –	385	Lu lutetium –	386	Yb ytterbium –	387	Tm thulium –	388	Er erbium –	389	Lu lutetium –	390	Yb ytterbium –	391	Tm thulium –	392	Er erbium –	393	Lu lutetium –	394	Yb ytterbium –	395	Tm thulium –	396	Er erbium –	397	Lu lutetium –	398	Yb ytterbium –	399	Tm thulium –	400	Er erbium –	401	Lu lutetium –	402	Yb ytterbium –	403	Tm thulium –	404	Er erbium –	405	Lu lutetium –	406	Yb ytterbium –	407	Tm thulium –	408	Er erbium –	409	Lu lutetium –	410	Yb ytterbium –	411	Tm thulium –	412	Er erbium –	413	Lu lutetium –	414	Yb ytterbium –	415	Tm thulium –	416	Er erbium –	417	Lu lutetium –	418	Yb ytterbium –	419	Tm thulium –	420	Er erbium –	421	Lu lutetium –	422	Yb ytterbium –	423	Tm thulium –	424	Er erbium –	425	Lu lutetium –	426	Yb ytterbium –	427	Tm thulium –	428	Er erbium –	429	Lu lutetium –	430	Yb ytterbium –	431	Tm thulium –	432	Er erbium –	433	Lu lutetium –	434	Yb ytterbium –	435	Tm thulium –	436	Er erbium –	437	Lu lutetium –	438	Yb ytterbium –	439	Tm thulium –	440	Er erbium –	441	Lu lutetium –	442	Yb ytterbium –	443	Tm thulium –	444	Er erbium –	445	Lu lutetium –	446	Yb ytterbium –	447	Tm thulium –	448	Er erbium –	449	Lu lutetium –	450	Yb ytterbium –	451	Tm thulium –	452	Er erbium –	453	Lu lutetium –	454	Yb ytterbium –	455	Tm thulium –	456	Er erbium –	457	Lu lutetium –	458	Yb ytterbium –	459