

Cambridge  
International  
AS & A Level

**Cambridge International Examinations**  
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE  
NAME

--

CENTRE  
NUMBER

--	--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--

**CHEMISTRY**

**9701/34**

Paper 3 Advanced Practical Skills 2

**October/November 2016**

**2 hours**

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.  
Give details of the practical session and laboratory where appropriate, in the boxes provided.  
Write in dark blue or black pen.  
You may use an HB pencil for any diagrams or graphs.  
Do not use staples, paper clips, glue or correction fluid.  
**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.  
Electronic calculators may be used.  
You may lose marks if you do not show your working or if you do not use appropriate units.  
Use of a Data Booklet is unnecessary.

Qualitative Analysis Notes are printed on pages 10 and 11.  
A copy of the Periodic Table is printed on page 12.

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.

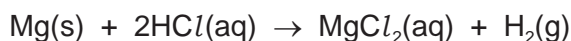
<b>Session</b>	
<b>Laboratory</b>	

<b>For Examiner's Use</b>	
<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>Total</b>	

This document consists of **12** printed pages.



- 1 You will find the relative atomic mass,  $A_r$ , of magnesium by measuring the volume of hydrogen produced when a known mass of metal reacts with an excess of acid.



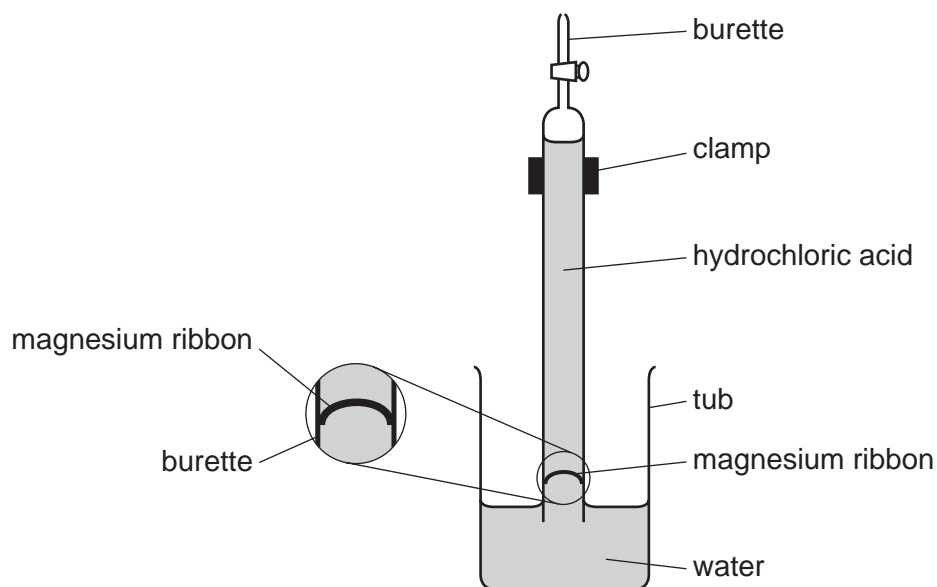
**FB 1** is  $1.00 \text{ mol dm}^{-3}$  hydrochloric acid,  $\text{HCl}$ .

**FB 2** is magnesium,  $\text{Mg}$ .

### (a) Method

**Read through the whole method before starting any practical work.**

- Fill the tub with water to a depth of about 5 cm.
- Weigh the magnesium, **FB 2**, and note its mass below. If you are using a balance reading to 1 decimal place and the reading with the magnesium is zero, you should record this value.
- Fill the burette to about the  $20 \text{ cm}^3$  mark with hydrochloric acid, **FB 1**.
- Add distilled water to reach the  $0 \text{ cm}^3$  mark on the burette.
- Bend the magnesium strip into a U-shape.
- Place the magnesium in the burette so that it is above the liquid and friction holds it in position. Use a glass rod to push the magnesium about 2 cm into the burette.
- Hold a piece of paper towel over the open end of the burette, invert the burette and immediately place it in the tub of water. Remove the paper towel and clamp the burette as shown in the diagram.
- The liquid level should now be on the scale of the burette. If it is not, open the tap for a moment to allow the level to drop.



- Record the initial reading on the burette. Remember that the scale is now upside down.
- Leave the apparatus so that the acid from the burette diffuses around the magnesium and reacts.
- You should start **Question 2 or Question 3** while waiting for the reaction to complete.
- When all the magnesium has reacted, note and record the final reading on the burette.
- Calculate the volume of hydrogen produced.

### Results

[3]

**(b) Calculations**

Show your working and appropriate significant figures in the final answer to **each** step of your calculations.

- (i)** Calculate the number of moles of hydrogen produced.  
(Assume that 1 mole of gas occupies  $24.0 \text{ dm}^3$  under these conditions.)

moles of  $\text{H}_2 = \dots\dots\dots \text{ mol}$

- (ii)** Use your answer to **(i)** and the mass of magnesium used to calculate the  $A_r$  of magnesium.  
(If you used a balance reading to 1 decimal place, you should assume that the mass of magnesium was  $0.04 \text{ g}$  correct to 2 decimal places.)

$A_r$  of Mg =  $\dots\dots\dots$   
[2]

- (c) (i)** Calculate the percentage error in the mass and volume readings in this experiment.

- (ii)** Suggest a change that could be made to reduce the greater error calculated in **(i)**.

.....  
.....  
[3]

- (d)** What would be the effect on the value of the  $A_r$  of magnesium calculated if the temperature of the room was much lower than that for your experiment? Explain your answer.

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

[Total: 10]

- 2 In **Question 1** you calculated the relative atomic mass,  $A_r$ , of magnesium by measuring the volume of hydrogen produced. The relative atomic mass can also be determined by investigating how much of the hydrochloric acid reacted with the magnesium.

The experiment described in **Question 1** was repeated, this time using 0.21 g of magnesium ribbon and 30.0 cm<sup>3</sup> of 1.00 mol dm<sup>-3</sup> hydrochloric acid. All the solution left in the burette and tub was kept and water added to make the total volume 250 cm<sup>3</sup>. This solution was labelled **FB 3**.

You will titrate **FB 3** using a known concentration of aqueous sodium carbonate to determine how much hydrochloric acid was left over after the reaction with magnesium.



**FB 3** is the solution of hydrochloric acid described above.

**FB 4** is aqueous sodium carbonate containing 2.64 g dm<sup>-3</sup> Na<sub>2</sub>CO<sub>3</sub>.  
bromophenol blue indicator

**(a) Method**

- Fill the burette with **FB 3**.
- Pipette 25.0 cm<sup>3</sup> of **FB 4** into a conical flask.
- Add about 10 drops of bromophenol blue indicator.
- Perform a rough titration and record your burette readings in the space below.

The rough titre is ..... cm<sup>3</sup>

- Carry out as many accurate titrations as you consider necessary to obtain consistent results.
- Record, in a suitable form below, all of your burette readings and the volume of **FB 3** added in each accurate titration.
- Make certain any recorded results show the precision of your practical work.

I	
II	
III	
IV	
V	
VI	
VII	

[7]

- (b) From your accurate titration results, obtain a suitable value for the volume of **FB 3** to be used in your calculations. Show clearly how you obtained this value.

25.0 cm<sup>3</sup> of **FB 4** required ..... cm<sup>3</sup> of **FB 3**. [1]

**(c) Calculations**

Show your working and appropriate significant figures in the final answer to **each** step of your calculations.

- (i) Use the information on page 4 and the Periodic Table on page 12 to calculate the number of moles of sodium carbonate in the 25.0 cm<sup>3</sup> of **FB 4** used in each titration.

moles of Na<sub>2</sub>CO<sub>3</sub> = ..... mol

- (ii) Use your answer to (i) to calculate the number of moles of hydrochloric acid present in the volume of **FB 3** recorded in (b).



moles of HCl present = ..... mol

- (iii) Use your answer to (ii) to calculate the number of moles of hydrochloric acid present in 250 cm<sup>3</sup> of **FB 3**.

moles of HCl present in 250 cm<sup>3</sup> = ..... mol

- (iv) Use the information on page 4 to calculate the number of moles of hydrochloric acid added to the magnesium.

moles of HCl added = ..... mol

- (v) Calculate the number of moles of hydrochloric acid that reacted with the magnesium.

moles of HCl that reacted with the magnesium = ..... mol

- (vi) Use your answer to (v) and the mass of magnesium used to calculate the relative atomic mass,  $A_r$ , of magnesium.



$A_r$  of Mg = .....  
[5]

- (d) A solution of sodium hydroxide was prepared at the same concentration, in  $\text{mol dm}^{-3}$ , as **FB 4**. A student repeated the titration but replaced **FB 4** with this solution of sodium hydroxide.

- (i) Explain the effect that replacing **FB 4** with this solution of sodium hydroxide would have on the volume of acid, **FB 3**, needed for the titration.

.....  
.....

- (ii) If the sodium hydroxide had been stored for a long time it would not be suitable for use to find the concentration of the acid.

Suggest why storage for a long time would make the sodium hydroxide unsuitable.

.....  
.....

[2]

[Total: 15]

### 3 Qualitative Analysis

At each stage of any test you are to record details of the following.

- colour changes seen
- the formation of any precipitate
- the solubility of such precipitates in an excess of the reagent added

Where gases are released they should be identified by a test, **described in the appropriate place in your observations.**

You should indicate clearly at what stage in a test a change occurs.

**No additional tests for ions present should be attempted.**

**If any solution is warmed, a boiling tube MUST be used.**

Rinse and reuse test-tubes and boiling tubes where possible.

**Where reagents are selected for use in a test, the name or correct formula of the element or compound must be given.**

- (a) (i) Half fill the 250 cm<sup>3</sup> beaker with water. Heat the water to about 80 °C and then turn off the Bunsen burner. This is the hot water bath needed in the following tests.

To a 3–4 cm depth of aqueous silver nitrate in a test-tube, add a few drops of aqueous sodium hydroxide to give a grey/brown precipitate. Then add aqueous ammonia dropwise until the precipitate **just** disappears. This solution is Tollens' reagent and is needed in a following test.

**FB 5**, **FB 6** and **FB 7** are each known to be one of ethanol, propanal and propanone.

Carry out the following tests and complete the table.

test	observations		
	FB 5	FB 6	FB 7
To a 1 cm depth in a test-tube, add a few drops of acidified potassium manganate(VII) and place in the hot water bath.			
To a 0.5 cm depth in a test-tube, add a 1 cm depth of aqueous potassium iodide and a 1 cm depth of sodium chlorate(I). (This gives the same result as adding iodine and alkali.)			
To a few drops in a test-tube, add a 1 cm depth of Tollens' reagent and place in the hot water bath. Leave for several minutes.			

(ii) Use these observations to identify the unknown compounds.

**FB 5** is .....

**FB 6** is .....

**FB 7** is .....

(iii) Choose another reagent that would give a similar result for propanal and propanone but a different result for ethanol.

**Do not carry out this test.**

reagent .....

result for propanal and propanone .....

result for ethanol .....

(iv) Choose another reagent that would give a similar result for ethanol and propanone but a different result for propanal.

**Do not carry out this test.**

reagent .....

result for ethanol and propanone .....

result for propanal .....

[8]



**(b) FB 8** contains one cation and one anion from those listed on pages 10 and 11.  
You are provided with solid **FB 8** and an aqueous solution of **FB 8**.

**(i)** To a 1 cm depth of aqueous **FB 8** in a test-tube add a 1 cm depth of aqueous sodium hydroxide.

Keep the test-tube and contents for test **(ii)**.

observation .....

**(ii)** Transfer the contents of the test-tube from test **(i)** into a boiling tube and heat gently and **carefully**.

Allow to cool and keep the boiling tube and contents for test **(iii)**.

observation .....

**(iii)** Transfer a 1 cm depth of the mixture from test **(ii)** into a boiling tube and add a 2 cm depth of dilute hydrochloric acid. Heat gently and **carefully**.

observation .....

Allow to cool and keep the boiling tube and contents for test **(iv)**.

**(iv)** To the boiling tube from test **(iii)** add a piece of aluminium foil. Leave the boiling tube to stand.

observation .....

.....

**(v)** Place a small spatula measure of solid **FB 8** in a hard-glass test-tube and heat it gently at first and then more strongly.

Identify **two** gases, other than water vapour, that are produced and give your evidence.

identity .....

evidence .....

identity .....

evidence .....

**(vi)** From your observations in **(i)** to **(v)**, write the formula of **FB 8**.

.....

**(vii)** Write the **ionic** equation for the reaction that is occurring in test **(i)**. Include state symbols.

.....

[7]

[Total: 15]

## Qualitative Analysis Notes

Key: [ppt. = precipitate]

## 1 Reactions of aqueous cations

ion	reaction with	
	NaOH(aq)	NH <sub>3</sub> (aq)
aluminium, Al <sup>3+</sup> (aq)	white ppt. soluble in excess	white ppt. insoluble in excess
ammonium, NH <sub>4</sub> <sup>+</sup> (aq)	no ppt. ammonia produced on heating	–
barium, Ba <sup>2+</sup> (aq)	no ppt. (if reagents are pure)	no ppt.
calcium, Ca <sup>2+</sup> (aq)	white ppt. with high [Ca <sup>2+</sup> (aq)]	no ppt.
chromium(III), Cr <sup>3+</sup> (aq)	grey-green ppt. soluble in excess	grey-green ppt. insoluble in excess
copper(II), Cu <sup>2+</sup> (aq)	pale blue ppt. insoluble in excess	blue ppt. soluble in excess giving dark blue solution
iron(II), Fe <sup>2+</sup> (aq)	green ppt. turning brown on contact with air insoluble in excess	green ppt. turning brown on contact with air insoluble in excess
iron(III), Fe <sup>3+</sup> (aq)	red-brown ppt. insoluble in excess	red-brown ppt. insoluble in excess
magnesium, Mg <sup>2+</sup> (aq)	white ppt. insoluble in excess	white ppt. insoluble in excess
manganese(II), Mn <sup>2+</sup> (aq)	off-white ppt. rapidly turning brown on contact with air insoluble in excess	off-white ppt. rapidly turning brown on contact with air insoluble in excess
zinc, Zn <sup>2+</sup> (aq)	white ppt. soluble in excess	white ppt. soluble in excess

## 2 Reactions of anions

<i>ion</i>	<i>reaction</i>
carbonate, $\text{CO}_3^{2-}$	$\text{CO}_2$ liberated by dilute acids
chloride, $\text{Cl}^-(\text{aq})$	gives white ppt. with $\text{Ag}^+(\text{aq})$ (soluble in $\text{NH}_3(\text{aq})$ )
bromide, $\text{Br}^-(\text{aq})$	gives cream ppt. with $\text{Ag}^+(\text{aq})$ (partially soluble in $\text{NH}_3(\text{aq})$ )
iodide, $\text{I}^-(\text{aq})$	gives yellow ppt. with $\text{Ag}^+(\text{aq})$ (insoluble in $\text{NH}_3(\text{aq})$ )
nitrate, $\text{NO}_3^-(\text{aq})$	$\text{NH}_3$ liberated on heating with $\text{OH}^-(\text{aq})$ and $\text{Al}$ foil
nitrite, $\text{NO}_2^-(\text{aq})$	$\text{NH}_3$ liberated on heating with $\text{OH}^-(\text{aq})$ and $\text{Al}$ foil; $\text{NO}$ liberated by dilute acids (colourless $\text{NO} \rightarrow$ (pale) brown $\text{NO}_2$ in air)
sulfate, $\text{SO}_4^{2-}(\text{aq})$	gives white ppt. with $\text{Ba}^{2+}(\text{aq})$ (insoluble in excess dilute strong acids)
sulfite, $\text{SO}_3^{2-}(\text{aq})$	gives white ppt. with $\text{Ba}^{2+}(\text{aq})$ (soluble in excess dilute strong acids)

## 3 Tests for gases

<i>gas</i>	<i>test and test result</i>
ammonia, $\text{NH}_3$	turns damp red litmus paper blue
carbon dioxide, $\text{CO}_2$	gives a white ppt. with limewater (ppt. dissolves with excess $\text{CO}_2$ )
chlorine, $\text{Cl}_2$	bleaches damp litmus paper
hydrogen, $\text{H}_2$	"pops" with a lighted splint
oxygen, $\text{O}_2$	relights a glowing splint

## The Periodic Table of Elements

		Group																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">1 H hydrogen 1.0</div> <div style="border: 1px solid black; padding: 2px;"> <b>Key</b>            atomic number            atomic symbol            name            relative atomic mass         </div> </div>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
3 Li lithium 6.9	4 Be beryllium 9.0	11 Na sodium 23.0	12 Mg magnesium 24.3	19 K potassium 39.1	20 Ca calcium 40.1	21 Sc scandium 45.0	22 Ti titanium 47.9	23 V vanadium 50.9	24 Cr chromium 52.0	25 Mn manganese 54.9	26 Fe iron 55.8	27 Co cobalt 58.9	28 Ni nickel 58.7	29 Cu copper 63.5	30 Zn zinc 65.4	31 Ga gallium 69.7	32 Ge germanium 72.6	33 As arsenic 74.9	34 Se selenium 79.0	35 Br bromine 79.9	36 Kr krypton 83.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
37 Rb rubidium 85.5	38 Sr strontium 87.6	39 Y yttrium 88.9	40 Zr zirconium 91.2	41 Nb niobium 92.9	42 Mo molybdenum 95.9	43 Tc technetium —	44 Ru ruthenium 101.1	45 Rh rhodium 102.9	46 Pd palladium 106.4	47 Ag silver 107.9	48 Cd cadmium 112.4	49 In indium 114.8	50 Sn tin 118.7	51 Sb antimony 121.8	52 Te tellurium 127.6	53 I iodine 126.9	54 Xe xenon 131.3	55 Cs caesium 132.9	56 Ba barium 137.3	57–71 lanthanoids —	72 Hf hafnium 178.5	73 Ta tantalum 180.9	74 W tungsten 183.8	75 Re rhenium 186.2	76 Os osmium 190.2	77 Ir iridium 192.2	78 Pt platinum 195.1	79 Au gold 197.0	80 Hg mercury 200.6	81 Tl thallium 204.4	82 Pb lead 207.2	83 Bi bismuth 209.0	84 Po polonium —	85 At astatine —	86 Rn radon —																																																																																																																																																																																																																																																																																																																																																																																																																																																			
87 Fr francium —	88 Ra radium —	89–103 actinoids —	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganesson —	119 Uue unbinilium —	120 Uub ununilium —	121 Uut unununium —	122 Uuq ununquadium —	123 Uup ununpentium —	124 Uuq ununhexium —	125 Uuh ununheptium —	126 Uuo ununoctium —	127 Uuq ununnonium —	128 Uuq unundecium —	129 Uuq ununtridecium —	130 Uuq ununpentadecium —	131 Uuq ununheptadecium —	132 Uuq ununnonadecium —	133 Uuq unununium —	134 Uuq ununbium —	135 Uuq ununtrium —	136 Uuq ununquadium —	137 Uuq ununpentium —	138 Uuq ununhexium —	139 Uuq ununheptium —	140 Uuq ununoctium —	141 Uuq ununnonium —	142 Uuq unundecium —	143 Uuq ununtridecium —	144 Uuq ununpentadecium —	145 Uuq ununheptadecium —	146 Uuq ununnonadecium —	147 Uuq unununium —	148 Uuq ununbium —	149 Uuq ununtrium —	150 Uuq ununquadium —	151 Uuq ununpentium —	152 Uuq ununhexium —	153 Uuq ununheptium —	154 Uuq ununoctium —	155 Uuq ununnonium —	156 Uuq unundecium —	157 Uuq ununtridecium —	158 Uuq ununpentadecium —	159 Uuq ununheptadecium —	160 Uuq ununnonadecium —	161 Uuq unununium —	162 Uuq ununbium —	163 Uuq ununtrium —	164 Uuq ununquadium —	165 Uuq ununpentium —	166 Uuq ununhexium —	167 Uuq ununheptium —	168 Uuq ununoctium —	169 Uuq ununnonium —	170 Uuq unundecium —	171 Uuq ununtridecium —	172 Uuq ununpentadecium —	173 Uuq ununheptadecium —	174 Uuq ununnonadecium —	175 Uuq unununium —	176 Uuq ununbium —	177 Uuq ununtrium —	178 Uuq ununquadium —	179 Uuq ununpentium —	180 Uuq ununhexium —	181 Uuq ununheptium —	182 Uuq ununoctium —	183 Uuq ununnonium —	184 Uuq unundecium —	185 Uuq ununtridecium —	186 Uuq ununpentadecium —	187 Uuq ununheptadecium —	188 Uuq ununnonadecium —	189 Uuq unununium —	190 Uuq ununbium —	191 Uuq ununtrium —	192 Uuq ununquadium —	193 Uuq ununpentium —	194 Uuq ununhexium —	195 Uuq ununheptium —	196 Uuq ununoctium —	197 Uuq ununnonium —	198 Uuq unundecium —	199 Uuq ununtridecium —	200 Uuq ununpentadecium —	201 Uuq ununheptadecium —	202 Uuq ununnonadecium —	203 Uuq unununium —	204 Uuq ununbium —	205 Uuq ununtrium —	206 Uuq ununquadium —	207 Uuq ununpentium —	208 Uuq ununhexium —	209 Uuq ununheptium —	210 Uuq ununoctium —	211 Uuq ununnonium —	212 Uuq unundecium —	213 Uuq ununtridecium —	214 Uuq ununpentadecium —	215 Uuq ununheptadecium —	216 Uuq ununnonadecium —	217 Uuq unununium —	218 Uuq ununbium —	219 Uuq ununtrium —	220 Uuq ununquadium —	221 Uuq ununpentium —	222 Uuq ununhexium —	223 Uuq ununheptium —	224 Uuq ununoctium —	225 Uuq ununnonium —	226 Uuq unundecium —	227 Uuq ununtridecium —	228 Uuq ununpentadecium —	229 Uuq ununheptadecium —	230 Uuq ununnonadecium —	231 Uuq unununium —	232 Uuq ununbium —	233 Uuq ununtrium —	234 Uuq ununquadium —	235 Uuq ununpentium —	236 Uuq ununhexium —	237 Uuq ununheptium —	238 Uuq ununoctium —	239 Uuq ununnonium —	240 Uuq unundecium —	241 Uuq ununtridecium —	242 Uuq ununpentadecium —	243 Uuq ununheptadecium —	244 Uuq ununnonadecium —	245 Uuq unununium —	246 Uuq ununbium —	247 Uuq ununtrium —	248 Uuq ununquadium —	249 Uuq ununpentium —	250 Uuq ununhexium —	251 Uuq ununheptium —	252 Uuq ununoctium —	253 Uuq ununnonium —	254 Uuq unundecium —	255 Uuq ununtridecium —	256 Uuq ununpentadecium —	257 Uuq ununheptadecium —	258 Uuq ununnonadecium —	259 Uuq unununium —	260 Uuq ununbium —	261 Uuq ununtrium —	262 Uuq ununquadium —	263 Uuq ununpentium —	264 Uuq ununhexium —	265 Uuq ununheptium —	266 Uuq ununoctium —	267 Uuq ununnonium —	268 Uuq unundecium —	269 Uuq ununtridecium —	270 Uuq ununpentadecium —	271 Uuq ununheptadecium —	272 Uuq ununnonadecium —	273 Uuq unununium —	274 Uuq ununbium —	275 Uuq ununtrium —	276 Uuq ununquadium —	277 Uuq ununpentium —	278 Uuq ununhexium —	279 Uuq ununheptium —	280 Uuq ununoctium —	281 Uuq ununnonium —	282 Uuq unundecium —	283 Uuq ununtridecium —	284 Uuq ununpentadecium —	285 Uuq ununheptadecium —	286 Uuq ununnonadecium —	287 Uuq unununium —	288 Uuq ununbium —	289 Uuq ununtrium —	290 Uuq ununquadium —	291 Uuq ununpentium —	292 Uuq ununhexium —	293 Uuq ununheptium —	294 Uuq ununoctium —	295 Uuq ununnonium —	296 Uuq unundecium —	297 Uuq ununtridecium —	298 Uuq ununpentadecium —	299 Uuq ununheptadecium —	300 Uuq ununnonadecium —	301 Uuq unununium —	302 Uuq ununbium —	303 Uuq ununtrium —	304 Uuq ununquadium —	305 Uuq ununpentium —	306 Uuq ununhexium —	307 Uuq ununheptium —	308 Uuq ununoctium —	309 Uuq ununnonium —	310 Uuq unundecium —	311 Uuq ununtridecium —	312 Uuq ununpentadecium —	313 Uuq ununheptadecium —	314 Uuq ununnonadecium —	315 Uuq unununium —	316 Uuq ununbium —	317 Uuq ununtrium —	318 Uuq ununquadium —	319 Uuq ununpentium —	320 Uuq ununhexium —	321 Uuq ununheptium —	322 Uuq ununoctium —	323 Uuq ununnonium —	324 Uuq unundecium —	325 Uuq ununtridecium —	326 Uuq ununpentadecium —	327 Uuq ununheptadecium —	328 Uuq ununnonadecium —	329 Uuq unununium —	330 Uuq ununbium —	331 Uuq ununtrium —	332 Uuq ununquadium —	333 Uuq ununpentium —	334 Uuq ununhexium —	335 Uuq ununheptium —	336 Uuq ununoctium —	337 Uuq ununnonium —	338 Uuq unundecium —	339 Uuq ununtridecium —	340 Uuq ununpentadecium —	341 Uuq ununheptadecium —	342 Uuq ununnonadecium —	343 Uuq unununium —	344 Uuq ununbium —	345 Uuq ununtrium —	346 Uuq ununquadium —	347 Uuq ununpentium —	348 Uuq ununhexium —	349 Uuq ununheptium —	350 Uuq ununoctium —	351 Uuq ununnonium —	352 Uuq unundecium —	353 Uuq ununtridecium —	354 Uuq ununpentadecium —	355 Uuq ununheptadecium —	356 Uuq ununnonadecium —	357 Uuq unununium —	358 Uuq ununbium —	359 Uuq ununtrium —	360 Uuq ununquadium —	361 Uuq ununpentium —	362 Uuq ununhexium —	363 Uuq ununheptium —	364 Uuq ununoctium —	365 Uuq ununnonium —	366 Uuq unundecium —	367 Uuq ununtridecium —	368 Uuq ununpentadecium —	369 Uuq ununheptadecium —	370 Uuq ununnonadecium —	371 Uuq unununium —	372 Uuq ununbium —	373 Uuq ununtrium —	374 Uuq ununquadium —	375 Uuq ununpentium —	376 Uuq ununhexium —	377 Uuq ununheptium —	378 Uuq ununoctium —	379 Uuq ununnonium —	380 Uuq unundecium —	381 Uuq ununtridecium —	382 Uuq ununpentadecium —	383 Uuq ununheptadecium —	384 Uuq ununnonadecium —	385 Uuq unununium —	386 Uuq ununbium —	387 Uuq ununtrium —	388 Uuq ununquadium —	389 Uuq ununpentium —	390 Uuq ununhexium —	391 Uuq ununheptium —	392 Uuq ununoctium —	393 Uuq ununnonium —	394 Uuq unundecium —	395 Uuq ununtridecium —	396 Uuq ununpentadecium —	397 Uuq ununheptadecium —	398 Uuq ununnonadecium —	399 Uuq unununium —	400 Uuq ununbium —	401 Uuq ununtrium —	402 Uuq ununquadium —	403 Uuq ununpentium —	404 Uuq ununhexium —	405 Uuq ununheptium —	406 Uuq ununoctium —	407 Uuq ununnonium —	408 Uuq unundecium —	409 Uuq ununtridecium —	410 Uuq ununpentadecium —	411 Uuq ununheptadecium —	412 Uuq ununnonadecium —	413 Uuq unununium —	414 Uuq ununbium —	415 Uuq ununtrium —	416 Uuq ununquadium —	417 Uuq ununpentium —	418 Uuq ununhexium —	419 Uuq ununheptium —	420 Uuq ununoctium —	421 Uuq ununnonium —	422 Uuq unundecium —	423 Uuq ununtridecium —	424 Uuq ununpentadecium —	425 Uuq ununheptadecium —	426 Uuq ununnonadecium —	427 Uuq unununium —	428 Uuq ununbium —	429 Uuq ununtrium —	430 Uuq ununquadium —	431 Uuq ununpentium —	432 Uuq ununhexium —	433 Uuq ununheptium —	434 Uuq ununoctium —	435 Uuq ununnonium —	436 Uuq unundecium —	437 Uuq ununtridecium —	438 Uuq ununpentadecium —	439 Uuq ununheptadecium —	440 Uuq ununnonadecium —	441 Uuq unununium —	442 Uuq ununbium —	443 Uuq ununtrium —	444 Uuq ununquadium —	445 Uuq ununpentium —	446 Uuq ununhexium —	447 Uuq ununheptium —	448 Uuq ununoctium —	449 Uuq ununnonium —	450 Uuq unundecium —	451 Uuq ununtridecium —	452 Uuq ununpentadecium —	453 Uuq ununheptadecium —	454 Uuq ununnonadecium —	455 Uuq unununium —	456 Uuq ununbium —	457 Uuq ununtrium —	458 Uuq ununquadium —	459 Uuq ununpentium —	460 Uuq ununhexium —	461 Uuq ununheptium —	462 Uuq ununoctium —	463 Uuq ununnonium —	464 Uuq unundecium —	465 Uuq ununtridecium —	466 Uuq ununpentadecium —	467 Uuq ununheptadecium —	468 Uuq ununnonadecium —	469 Uuq unununium —	470 Uuq ununbium —	471 Uuq ununtrium —	472 Uuq ununquadium —	473 Uuq ununpentium —	474 Uuq ununhexium —	475 Uuq ununheptium —	476 Uuq ununoctium —	477 Uuq ununnonium —	478 Uuq unundecium —	479 Uuq ununtridecium —	480 Uuq ununpentadecium —	481 Uuq ununheptadecium —	482 Uuq ununnonadecium —	483 Uuq unununium —	484 Uuq ununbium —	485 Uuq ununtrium —	486 Uuq ununquadium —	487 Uuq ununpentium —	488 Uuq ununhexium —	489 Uuq ununheptium —	490 Uuq ununoctium —	491 Uuq ununnonium —	492 Uuq unundecium —	493 Uuq ununtridecium —	494 Uuq ununpentadecium —	495 Uuq ununheptadecium —	496 Uuq ununnonadecium —	497 Uuq unununium —	498 Uuq ununbium —	499 Uuq ununtrium —	500 Uuq ununquadium —	501 Uuq ununpentium —	502 Uuq ununhexium —	503 Uuq ununheptium —	504 Uuq ununoctium —	505 Uuq ununnonium —	506 Uuq unundecium —	507 Uuq ununtridecium —	508 Uuq ununpentadecium —	509 Uuq ununheptadecium —	510 Uuq ununnonadecium —	511 Uuq unununium —	512 Uuq ununbium —	513 Uuq ununtrium —	514 Uuq ununquadium —	515 Uuq ununpentium —	516 Uuq ununhexium —	517 Uuq ununheptium —	518 Uuq ununoctium —	519 Uuq ununnonium —	520 Uuq unundecium —	521 Uuq ununtridecium —	522 Uuq ununpentadecium —	523 Uuq ununheptadecium —	524 Uuq ununnonadecium —	525 Uuq unununium —	526 Uuq ununbium —	527 Uuq ununtrium —	528 Uuq ununquadium —	529 Uuq ununpentium —	530 Uuq ununhexium —	531 Uuq ununheptium —	532 Uuq ununoctium —	533 Uuq ununnonium —	534 Uuq unundecium —	535 Uuq ununtridecium —	536 Uuq ununpentadecium —	537 Uuq ununheptadecium —	538 Uuq ununnonadecium —	539 Uuq unununium —	540 Uuq ununbium —	541 Uuq ununtrium —	542 Uuq ununquadium —	543 Uuq ununpentium —	544 Uuq ununhexium —	545 Uuq ununheptium —	546 Uuq ununoctium —	547 Uuq ununnonium —	548 Uuq unundecium —	549 Uuq ununtridecium —	550 Uuq ununpentadecium —	551 Uuq ununheptadecium —	552 Uuq ununnonadecium —	553 Uuq unununium —	554 Uuq ununbium —	555 Uuq ununtrium —	556 Uuq ununquadium —	557 Uuq ununpentium —	558 Uuq ununhexium —	559 Uuq ununheptium —	560 Uuq ununoctium —	561 Uuq ununnonium —	562 Uuq unundecium —	563 Uuq ununtridecium —	564 Uuq ununpentadecium —	565 Uuq ununheptadecium —	566 Uuq ununnonadecium —	567 Uuq unununium —	568 Uuq ununbium —	569 Uuq ununtrium —	570 Uuq ununquadium —	571 Uuq ununpentium —