



**BEATTY SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2020**

SUBJECT	: CHEMISTRY	LEVEL	: Sec 4 Express
PAPER	: 6092/01	DURATION	: 1 hour
SETTER	: Mdm Low Beng Hong	DATE	: 1 Sep 2020

CLASS :	NAME :	REG NO :
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READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Write your name, class and register number on the Optical Answer Sheet provided.

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

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 13.

The use of an approved scientific calculator is expected, where appropriate.

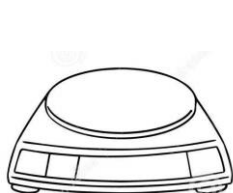
- 1 The diagram shows four pieces of laboratory apparatus.

electronic balance

measuring cylinder

stop watch

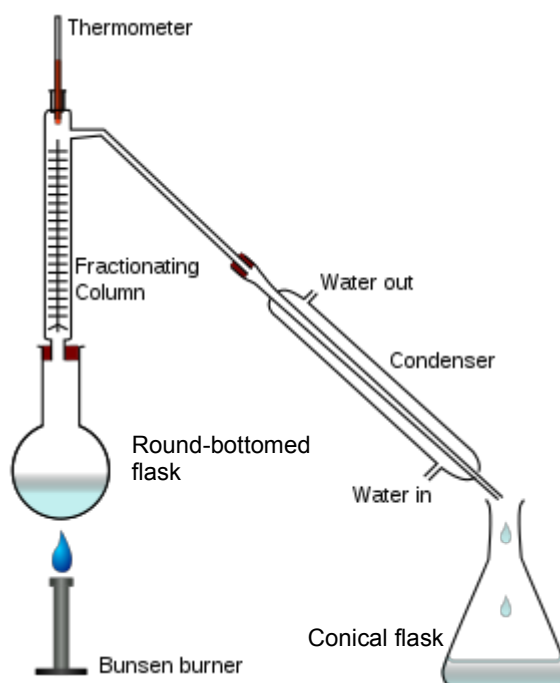
thermometer



Which apparatus is/are essential to find out if dissolving a salt in water is an endothermic process?

	electronic balance	measuring cylinder	stop watch	thermometer
A	X	X	X	✓
B	✓	X	X	✓
C	X	✓	X	✓
D	✓	✓	✓	X

- 2 Equal volumes of two liquids to be separated are placed in the apparatus below.



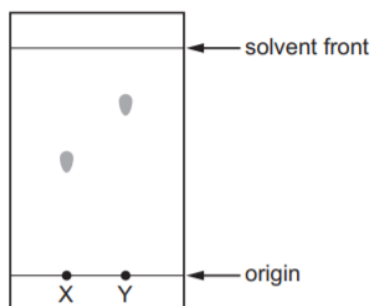
The purity of each liquid collected can be improved by

- A** adding boiling chips into the round-bottomed flask
- B** using a longer condenser
- C** using a longer fractionating column
- D** stoppering the conical flask

- 3 The results of a paper chromatography experiment are shown.

X is an aqueous solution of a salt of a Group I element.

Y is an aqueous solution of a salt of a transition element.



Which row is correct?

	larger R_f value	requires a locating agent
A	X	X
B	X	Y
C	Y	X
D	Y	Y

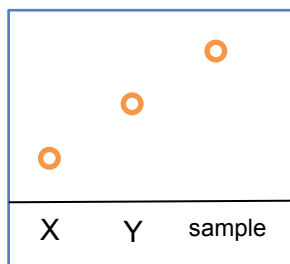
- 4 An organic chemist attempts to synthesise a new fragrance (a compound) by the following chemical reaction.



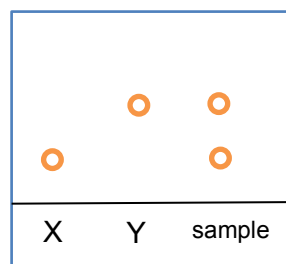
After one hour, a sample of the fragrance is removed and compared with pure samples of compounds X and Y using paper chromatography.

Which chromatogram shows that the reaction has produced a pure sample of the fragrance?

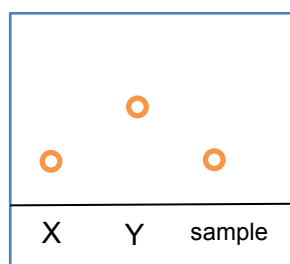
A



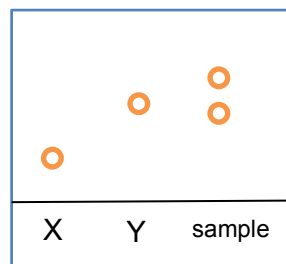
B



C



D



- 5 A chemist wants to obtain hexane (boiling point 68 °C) from a mixture of hexane and water. What is the best method to use?

A fractional distillation **B** paper chromatography
C separating funnel **D** simple distillation

- 6 The table gives data about four substances.

	melting point / °C	boiling point / °C
W	-182	-162
X	-112	-108
Y	-7	59
Z	39	688

When the ambient temperature is cooled to -110 °C, which substance(s) has/have particles in a disorderly arrangement?

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

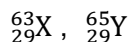
- 7 Mineral wool soaked in aqueous ammonia is placed in the apparatus shown.



After five minutes, the damp red litmus paper turned blue. Which process led to this change?

A crystallisation
B condensation
C diffusion
D sublimation

- 8 The nuclide notations for two atoms are given below, along with two possibly correct statements.



Statement 1: Both atoms are isotopes of copper.

Statement 2: Both atoms have variable oxidation states.

Which of the following is correct?

A Both statements are correct and statement 2 explains statement 1.
B Both statements are correct but statement 2 does not explain statement 1.
C Statement 1 is correct but statement 2 is incorrect.
D Statement 2 is correct but statement 1 is incorrect.

9 Which statement is correct for ${}^9_4\text{Be}^{2+}$?

- A Most of the ion consists of empty space.
- B The ion contains 15 subatomic particles in the nucleus.
- C The ion contains more protons than neutrons in the nucleus.
- D The ion has an electronic arrangement of 2.2.

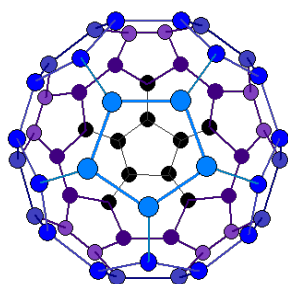
10 Which substances do **not** contain covalent bonds?

- 1 aqueous hydrochloric acid
- 2 ethanoic acid
- 3 helium gas
- 4 sulfur

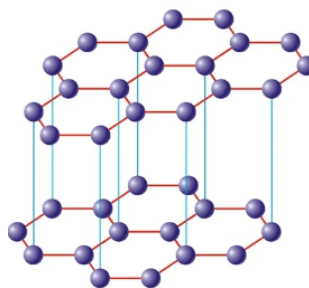
- A 1 and 2
- C 2 and 3

- B 1 and 3
- D 3 and 4

11 Buckminsterfullerene has the formula of C_{60} . The bonding in Buckminsterfullerene is similar to the bonding in graphite. Their structures are as shown.



Buckminsterfullerene



graphite

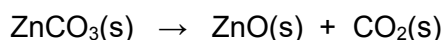
Four statements regarding the Buckminsterfullerene are given below.

- The melting point of Buckminsterfullerene is higher than that of graphite.
- Buckminsterfullerene is a good electrical conductor.
- Buckminsterfullerene is a good lubricant.
- On complete combustion, Buckminsterfullerene forms carbon dioxide and water.

How many of these statements are true?

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

12 Some students wish to make 0.970 mol of zinc oxide by the reaction shown below. They are told that the reaction gives a 95.0% yield.



What mass of zinc carbonate should they heat?

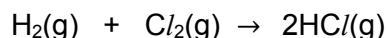
- A 83.2 g
- B 117 g
- C 121 g
- D 128 g

- 13 An element, E, forms a hydride, EH_4 , which contains 90% by mass of E.

Find the relative atomic mass of E.

- A 9 B 36 C 86 D 90

- 14 50 cm^3 of hydrogen is mixed with 25 cm^3 of chlorine. The gases react as shown in the equation below.



What is the total volume of gas present at the end of the reaction?

- A 50 cm^3 B 75 cm^3 C 100 cm^3 D 125 cm^3

- 15 What is the total number of electrons and protons in one mole of hydrogen gas?

- A 2 B 4
C 1.2×10^{24} D 2.4×10^{24}

- 16 The table gives information about three indicators.

indicator	colour change		pH at which colour change takes place
	low pH	high pH	
methyl orange	red	yellow	4.0
bromothymol blue	yellow	blue	6.5
phenolphthalein	colourless	pink	9.0

If equal volumes of these three indicators were mixed, which colour would be observed at pH 5?

- A blue
B green
C orange
D yellow

- 17 Which of the following is the same for 1 mol/dm^3 of hydrochloric acid and 1 mol/dm^3 of ethanoic acid?

- 1 electrical conductivity
- 2 volume of sodium hydroxide for neutralisation

- A 1 only
B 2 only
C both 1 and 2
D neither 1 nor 2

18 How many barium salts can be obtained by the following preparation methods?

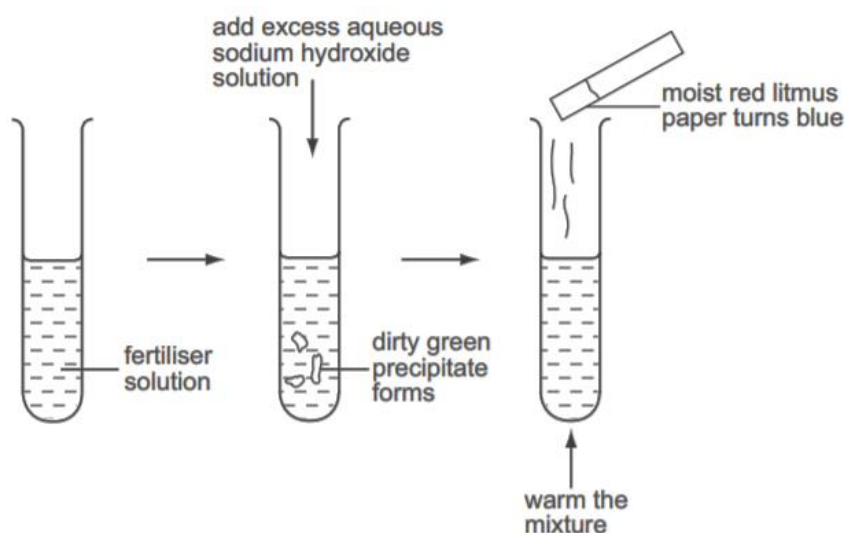
- addition of aqueous barium nitrate to aqueous sodium chloride
- addition of excess barium carbonate to hydrochloric acid
- addition of excess barium oxide to sulfuric acid
- titration of aqueous barium hydroxide with hydrochloric acid

A 1 B 2 C 3 D 4

19 A white crystalline solid is dissolved in distilled water. A small amount of dilute nitric acid is added followed by aqueous silver nitrate. No visible change occurs. What can be deduced about the white crystalline solid?

- A It contains chloride ions.
B It contains bromide ions.
C It does not contain carbonate ions.
D It must contain sulfate ions.

20 A solution of fertiliser was tested as shown.



Which ions must be present in the fertiliser?

- A NH_4^+ and NO_3^-
B NH_4^+ and Fe^{2+}
C Fe^{2+} and NO_3^-
D Fe^{3+} and NO_3^-

21 A gas, R, has the following properties:

- odourless and colourless
- no effect on damp litmus papers
- turns purple acidified potassium manganate(VII) colourless

What gas is R likely to be?

- A carbon dioxide
- B carbon monoxide
- C hydrogen sulfide
- D sulfur dioxide

22 Which of the following is the most powerful reducing agent?

- A bromine atom
- B chlorine atom
- C fluoride ion
- D iodide ion

23 Ammonium metavanadate, NH_4VO_3 , can be used to make a solution containing VO_2Cl .

What is the change in the oxidation number of vanadium in this reaction?

- A -1 B 0 C +1 D +2

24 Which equation shows hydrogen peroxide behaving as a reducing agent?

- A $2\text{Fe}^{2+}(\text{aq}) + \text{H}_2\text{O}_2(\text{l}) + 2\text{H}^+(\text{aq}) \rightarrow 2\text{Fe}^{3+}(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
- B $2\text{I}^-(\text{aq}) + \text{H}_2\text{O}_2(\text{l}) + 2\text{H}^+(\text{aq}) \rightarrow \text{I}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
- C $\text{MnO}_2(\text{s}) + \text{H}_2\text{O}_2(\text{l}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Mn}^{2+}(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$
- D $\text{PbS}(\text{s}) + 4\text{H}_2\text{O}_2(\text{l}) \rightarrow \text{PbSO}_4(\text{s}) + 4\text{H}_2\text{O}(\text{l})$

25 Which equation represents a redox reaction?

- A $\text{NaH}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{NaOH}(\text{aq}) + \text{H}_2(\text{g})$
- B $\text{CaCO}_3(\text{s}) \rightarrow \text{CO}_2(\text{g}) + \text{CaO}(\text{s})$
- C $\text{CuCl}_2(\text{aq}) + \text{K}_2\text{S}(\text{aq}) \rightarrow \text{CuS}(\text{s}) + 2\text{KCl}(\text{aq})$
- D $\text{HCl}(\text{aq}) + \text{NH}_3(\text{aq}) \rightarrow \text{NH}_4\text{Cl}(\text{aq})$

26 Which statements are true about all the noble gases?

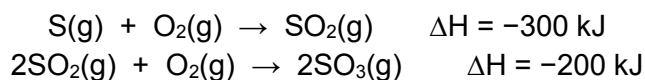
- 1 The melting point increases down the group.
- 2 They all have eight electrons in their outer shell.
- 3 They are coloured gases.
- 4 They are insoluble in water.

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

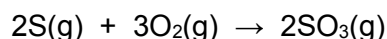
27 Selenium is an element in Group VI. Which statement about selenium is correct?

- A Selenium dioxide is a basic oxide.
- B Selenium disulfide has the formula SeS_2 .
- C Selenium forms the ion Se^{2+} in compounds.
- D Selenium has a high melting point and boiling point.

28 The equations and enthalpy changes for two reactions used in the manufacture of sulfuric acid are

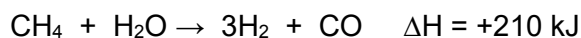


What is the enthalpy change, in kJ, for the reaction below?



- | | |
|--------|--------|
| A -100 | B -400 |
| C -500 | D -800 |

29 An equation for a reaction in which hydrogen is formed is



Which energy change occurs when 1 mol of hydrogen is formed in this reaction?

- A 70 kJ of energy are absorbed from the surroundings.
- B 70 kJ of energy are released to the surroundings.
- C 210 kJ of energy are absorbed from the surroundings.
- D 210 kJ of energy are released to the surroundings.

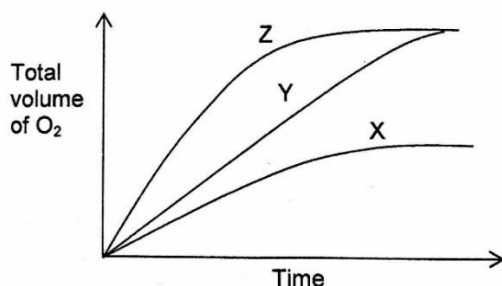
30 Which equation has a negative value of enthalpy change?

- A $\text{CO}_2\text{(s)} \rightarrow \text{CO}_2\text{(g)}$
- B $\text{Cl(g)} + \text{e}^- \rightarrow \text{Cl}^-\text{(g)}$
- C $\text{Cl}_2\text{(g)} \rightarrow 2\text{Cl(g)}$
- D $\text{NH}_4\text{Cl(s)} \rightarrow \text{NH}_4\text{Cl(aq)}$

31 When 50 cm³ of 1 mol/dm³ HCl is mixed with 50 cm³ of 1 mol/dm³ NaOH, the temperature of the resulting solution increases by 6 °C. What will be the temperature change when 100 cm³ of each of these solutions are mixed?

- | | |
|---------|---------|
| A 3 °C | B 6 °C |
| C 12 °C | D 24 °C |

- 32 Several experiments were carried out to measure the rate of decomposition of hydrogen peroxide, and the results were plotted in a graph.



The variables used in the experiments to give graphs X and Y are given below.

	volume of H_2O_2 / cm^3	concentration of H_2O_2 in mol/dm^3	temperature / $^\circ\text{C}$	mass of MnO_2 / g
X	50	0.5	25	0.1
Y	100	0.5	25	0.1

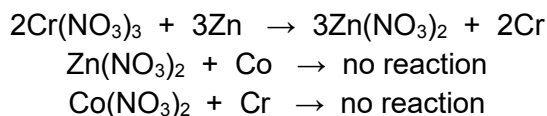
What could the variables be in the experiment to give graph Z?

- 1 50 cm^3 of 0.5 mol/dm^3 H_2O_2 at 30 $^\circ\text{C}$ with 0.1 g MnO_2
- 2 50 cm^3 of 1.0 mol/dm^3 H_2O_2 at 25 $^\circ\text{C}$ with 0.1 g MnO_2
- 3 50 cm^3 of 0.5 mol/dm^3 H_2O_2 at 25 $^\circ\text{C}$ with 0.5 g MnO_2

- A 1 only
C 1 and 2

- B 2 only
D 1 and 3

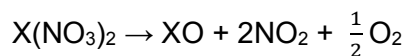
- 33 The equations below show the reactivity of various metals.



From the information, the order of **increasing** reactivity of the metals is

	least reactive $\longrightarrow$ most reactive		
A	Co	Cr	Zn
B	Co	Zn	Cr
C	Cr	Co	Zn
D	Zn	Cr	Co

- 34 Group II nitrates undergo thermal decomposition according to the following equation.

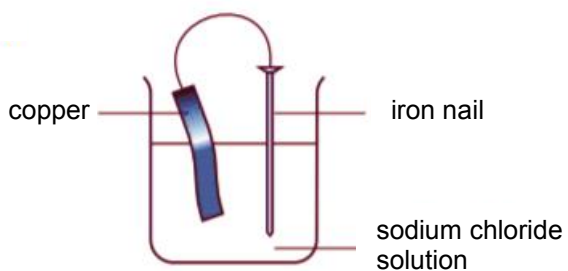


Which Group II nitrate requires the highest temperature to bring about its thermal decomposition?

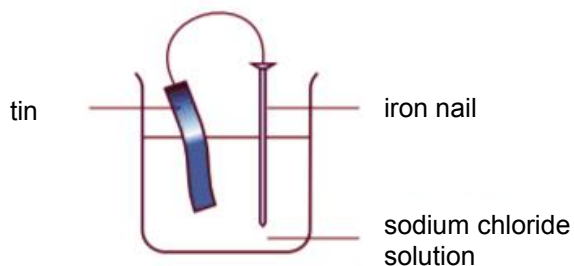
- A barium nitrate
- B calcium nitrate
- C magnesium nitrate
- D strontium nitrate

- 35 In which experiment would the iron nail **not** rust?

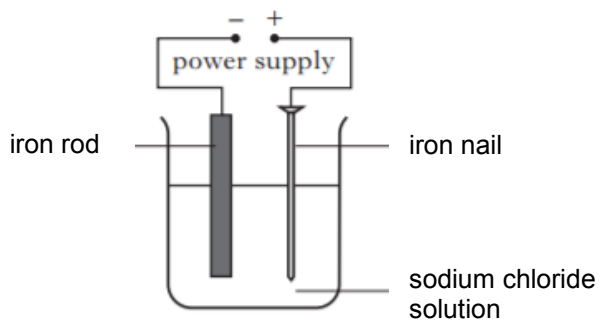
A



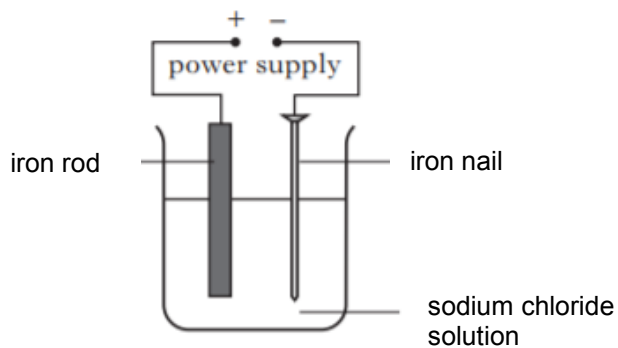
B



C



D



- 36 In which parts of a motor car do the reactions, shown in the equations, take place?

	$\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO} + 2\text{CO}$	$2\text{CO} + 2\text{NO} \rightarrow 2\text{CO}_2 + \text{N}_2$
A	engine	engine
B	engine	exhaust
C	exhaust	engine
D	exhaust	exhaust

- 37 During the electrolysis of an aqueous solution of a molybdenum salt, 21 g of molybdenum is deposited at the cathode by 2 moles of electrons. What is the formula of the molybdenum ion? (A_r of Mo = 42)

A Mo^+ B Mo^- C Mo^{2+} D Mo^{4+}

- 38 The same quantity of electricity is passed through separate dilute solutions of sulfuric acid and copper(II) sulfate using platinum electrodes under the same conditions.

Which statement is correct?

- A The amount of copper deposited at the cathode in the copper(II) sulfate solution is half the amount of hydrogen gas formed at the cathode in the sulfuric acid solution.
 B The pH of both solutions increases as the electrolysis proceeds.
 C The same volume of hydrogen is obtained in both cases.
 D The same volume of oxygen is obtained in both cases.

- 39 A simple cell is made from magnesium and iron half-cells. Which statement is correct when the cell produces electricity?

- A Electrons are lost from magnesium atoms.
 B Electrons flow from the iron half-cell to the magnesium half-cell.
 C Negative ions migrate to the iron half-cell.
 D The concentration of Fe^{2+} ions increases.

- 40 Electrolysis is used to plate a metal statue with silver. The statue is an electrode in a suitable electrolyte. Which row is correct?

	statue	electrolyte
A	anode	AgCl(s)
B	anode	$\text{AgNO}_3(\text{aq})$
C	cathode	AgCl(s)
D	cathode	$\text{AgNO}_3(\text{aq})$

The Periodic Table of Elements

Group																	
I	II	1 Hhydrogen1										III	IV	V	VI	VII	0
		Key proton (atomic) number atomic symbol name relative atomic mass															
3 Li lithium 7	4 Be beryllium 9																
11 Na sodium 23	12 Mg magnesium 24																
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 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	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 -		114 Fl flerovium -		116 Lv livermorium -		

lanthanoids

57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium -	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium -	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium -	94 Pu plutonium -	95 Am americium -	96 Cm curium -	97 Bk berkelium -	98 Cf californium -	99 Es einsteinium -	100 Fm fermium -	101 Md mendelevium -	102 No nobelium -	103 Lr lawrencium -

actinoids

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