NAME:	NO:	CLASS:

RIVERSIDE SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2022

SUBJECT : CHEMISTRY

PAPER : 6092/01

LEVEL/STREAM : 4 Express

DURATION : 1 Hour

READ THESE INSTRUCTIONS FIRST

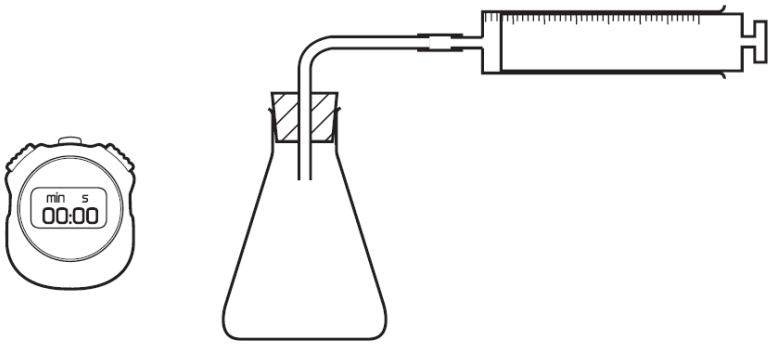
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, register number and class on the Answer Sheet in the spaces provided unless this has been done for you.

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 question paper.
A copy of the Periodic Table is printed on page 18.
The use of an approved scientific calculator is expected, where appropriate.

1 The apparatus shown can be used to find the rate of some chemical reactions.



The rate of which reaction can be followed using these apparatus?

A $Cu + H_2SO_4$

B $NaOH + CuSO_4$

C $Mg(HCO_3)_2 + HCl$

D $NaOH + HCl$

2 The melting and boiling points of four substances are shown in the table.

Which substance will be condensed if passed through a water condenser at room temperature?

	hydrocarbon	melting point/ °C	boiling point/ °C
A	butane	-135	0
B	carbon dioxide	-78.5	-78.5
C	pentane	-130	38
D	propane	-190	-45

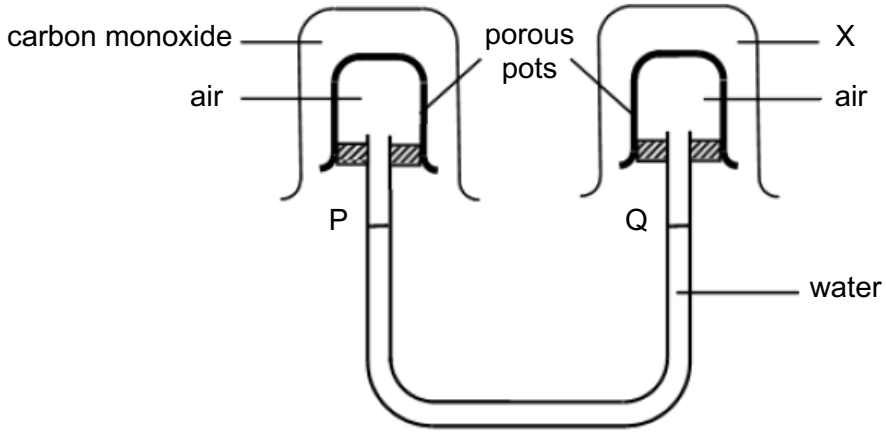
3 An acid, X, was added to a solution of the nitrate of metal Y.

A white precipitate was formed.

What are X and Y?

	X	Y
A	dilute hydrochloric acid	calcium
B	dilute hydrochloric acid	zinc
C	dilute sulfuric acid	aluminium
D	dilute sulfuric acid	barium

4 This experiment was set up to investigate the movement of gaseous substances.



The water level at P moved down initially.

What is substance X?

A helium

B methane

C nitrogen

D nitrogen oxide

5 A radioactive isotope of carbon has more nucleons than the non-radioactive isotope, $^{12}_{6}C$.

Which row is correct for an atom of a radioactive isotope of carbon?

	protons	neutrons	electrons
A	6	6	6
B	6	8	6
C	12	6	6
D	12	12	12

6 Substance T has the properties described below.

- conducts electricity when molten
- melting point higher than 600 °C
- highly soluble in water

What is substance T?

A ammonia

B copper(II) oxide

C magnesium chloride

D zinc

7 When solid iodine is heated, it sublimes and changes into a purple gas.

Which statement describes the process?

A Attractive forces between iodine molecules are overcome.

B Covalent bonds between iodine molecules are broken.

C Intermolecular forces between iodine atoms are overcome.

D Ionic bonds between the iodine atoms are weakened.

8 Which molecule has the **largest** number of electrons involved in covalent bonds?

A carbon dioxide

B ethene

C methanol

D nitrogen

9 Which substance is a metal?

	conduct electricity		physical state of product formed on reaction with oxygen
	when solid	when liquid	
A	✓	✓	solid
B	✓	✓	gas
C	✗	✓	no reaction
D	✗	✗	solid

10 The formula for hydrated sodium carbonate is $Na_2CO_3.xH_2O$. It contains 62.9% water of crystallisation by mass.

Which other information is needed to determine the value of *x*?

A atomic numbers of carbon, oxygen and sodium

B atomic numbers of carbon, oxygen, sodium and hydrogen

C relative atomic masses of carbon, oxygen and sodium

D relative atomic masses of carbon, oxygen, sodium and hydrogen

11 A 25.0 cm^3 sample of dilute sulfuric acid contains 0.05 moles of the acid.

What is the concentration of hydrogen ion in the solution?

A 1.0 mol/dm^3

B 2.0 mol/dm^3

C 4.0 mol/dm^3

D 8.0 mol/dm^3

12 126 g of potassium manganate(VII), $KMnO_4$, is needed for the complete oxidation of 46 g of ethanol, C_2H_5OH, under acidic conditions.

How many moles of ethanol can be completely oxidised by one mole of potassium manganate(VII) under these conditions?

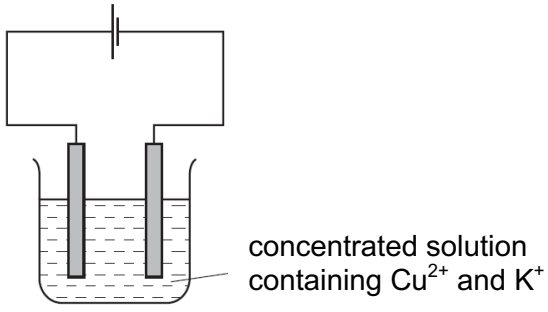
A 0.37

B 0.80

C 1.00

D 1.25

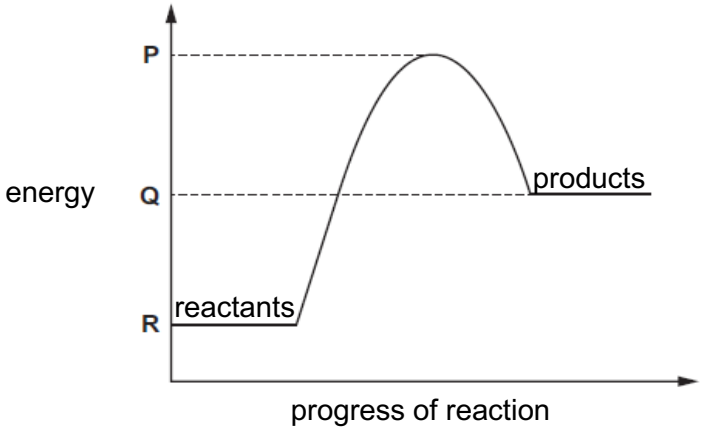
13 The diagram shows the electrolysis of a concentrated aqueous solution containing both copper(II) ions and potassium ions.



Which metal is deposited at the negative electrode and why?

	metal deposited	reason
A	copper	copper is less reactive than hydrogen
B	copper	copper is more reactive than hydrogen
C	potassium	potassium is less reactive than hydrogen
D	potassium	potassium is more reactive than copper

14 The energy profile diagram for the **forward** reaction of a reversible reaction is shown.



For the **reverse** reaction, which statement is correct?

A It is endothermic and the activation energy is P – Q.

B It is endothermic and the activation energy is P – R.

C It is exothermic and the activation energy is P – Q.

D It is exothermic and the activation energy is P – R.

15 0.24 g of magnesium ribbon was allowed to react at 25 ^{o}C with 20 cm^3 of 1.0 mol/dm^3 dilute hydrochloric acid.

Which factor would **not** result in an increase in the initial rate of the reaction?

A carrying out the reaction at 30 ^{o}C

B using 40 cm^3 of 1.0 mol/dm^3 dilute hydrochloric acid

C using a catalyst

D using powdered magnesium

16 At the start of a reaction, 1.00 dm^3 of a solution contains 0.300 mol of ethanol.

After 100 seconds, the concentration of the ethanol decreased to 0.297 mol/dm^3.

What is the rate of reaction over the first 100 seconds?

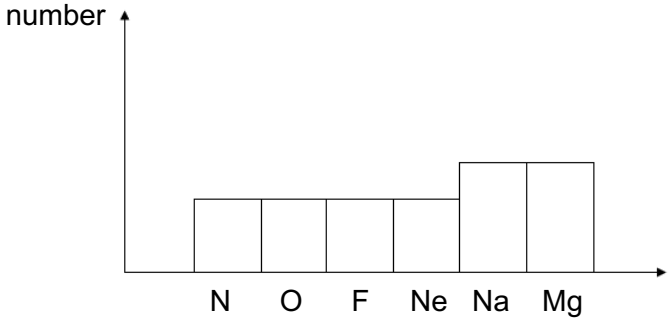
A 2.96×10^{-3} mol/dm^3 / s

B 3.00×10^{-5} mol/dm^3 / s

C 4.00×10^{-5} mol/dm^3 / s

D 8.00×10^{-5} mol/dm^3 / s

17 The chart shows the variation for a specific 'number' related to the elements, nitrogen to magnesium.



According to the trend, what is this 'number'?

A the number of electron shells

B the number of protons and neutrons

C the number of valence electrons

D the oxidation number

18 Oxidising strength is a relative term used to denote how certain elements oxidise other elements with respect to each other.

Which list represents the halogen in decreasing order of oxidising strength?

	decreasing oxidising strength →		
A	chlorine	bromine	iodine
B	chlorine	iodine	bromine
C	iodine	bromine	chlorine
D	iodine	chlorine	bromine

19 The list gives four oxides.

1 carbon dioxide

2 copper(II) oxide

3 magnesium oxide

4 zinc oxide

Which pair of oxides can react with sodium hydroxide?

A 1 and 2

B 1 and 4

C 2 and 4

D 3 and 4

20 Salt P is prepared by reacting aqueous metal carbonate and dilute acid.

Which is salt P?

A copper(II) chloride

B silver chloride

C sodium nitrate

D zinc sulfate

21 The reaction in the Haber process is represented as

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92 \text{ kJ}$$

Which statement about the Haber process is **incorrect**?

A 92 kJ of heat is given off when 2 mol of ammonia are formed.

B Iron is used as catalyst.

C The process is carried out at a high pressure of 250 atm.

D When 2 mol of N_2 and 6 mol of H_2 are used, 4 mol of NH_3 are collected.

22 The list gives four pairs of compounds.

1 ammonium nitrate and calcium hydroxide

2 ammonium nitrate and calcium nitrate

3 ammonium sulfate and calcium carbonate

4 ammonium sulfate and calcium oxide

Which pairs will produce ammonia when warmed together?

A 1 and 2 only

B 1 and 4 only

C 2 and 4 only

D 3 and 4 only

23 The table shows data for atoms or ions of the elements P, Q, R and S. The letters do not represent the chemical symbols of the elements.

	number of electrons	number of protons
P	11	11
Q	10	13
R	18	17
S	18	18

Which statement is correct?

A P and S are inert.

B Q and R form a compound with a formula QR_3.

C P combines with oxygen to form acidic oxides.

D R and S have different number of valence electrons.

24 Which statement(s) is/are true about **all** the noble gases?

1 The number of protons in their atoms equals the number of neutrons.

2 They all have eight electrons in their outer shell.

3 They do not react to form ionic compounds.

A 1, 2 and 3 only

B 1 and 2 only

C 2 only

D 3 only

25 Which element in the table is likely to be a transition metal?

	melting point	colour of chloride	variable oxidation state	use as catalyst
A	high	blue	yes	yes
B	low	green	no	yes
C	high	white	yes	no
D	low	white	no	no

26 Properties of an element and its compounds can be predicted from the position of the element in the Periodic Table.

What property **cannot** be predicted in this way?

A The catalytic property of the element or its compound.

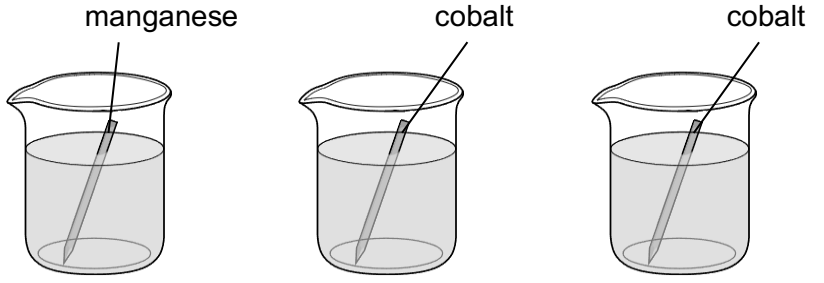
B The nature of the oxide of the element.

C The number of isotopes the element has.

D The reactivity of the element.

27 Three experiments to compare the reactivity of three metals are shown in the diagram.

Arrange them from least reactive to most reactive.

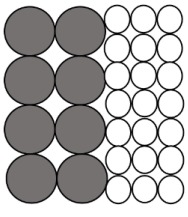


	tin sulfate solution	tin sulfate solution	manganese sulfate solution
result:	tin deposited on manganese	tin deposited on cobalt	no reaction

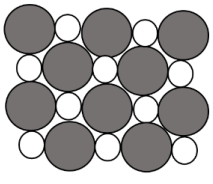
	least reactive → most reactive		
A	cobalt	tin	manganese
B	tin	cobalt	manganese
C	manganese	cobalt	tin
D	manganese	tin	cobalt

28 Which diagram best represents an alloy?

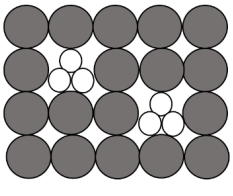
A



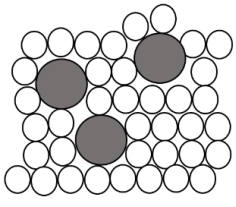
B



C



D



29 A block of magnesium is attached to an underground steel pipe.

Which will happen if a block of lead is used instead of magnesium?

A All of the lead will be oxidised.

B Iron in steel will be oxidised to form Fe^{3+}.

C The steel will corrode as it gets reduced.

D The steel will produce green deposits.

30 The metal beryllium does not react with cold water.

It reacts with dilute hydrochloric acid but cannot be extracted from its ore by using carbon.

Where should it be placed in the reactivity series?

magnesium

A

zinc

B

iron

C

copper

D

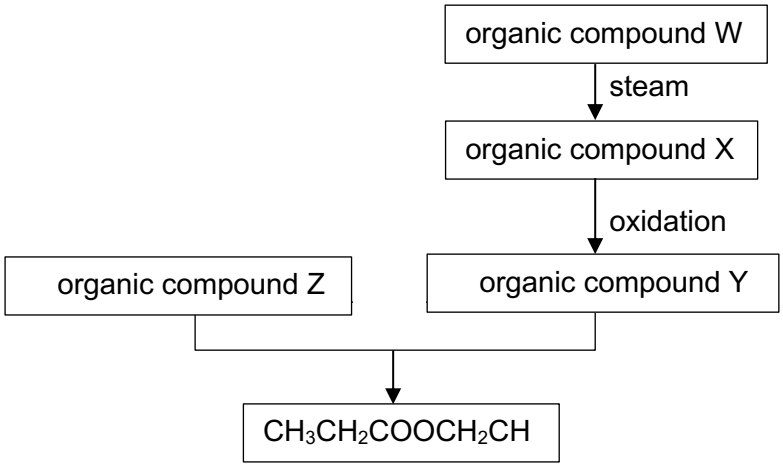
31 Which row correctly compares carbon dioxide and water vapour?

	both formed during respiration	both present in unpolluted air
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

32 Which molecule is **not** formed when pentane reacts with chlorine in the presence of sunlight?

A $C_5H_6Cl_6$ **B** $C_5H_{10}Cl_2$ **C** $C_5H_5Cl_4$ **D** $C_5H_4Cl_8$

33 An odour of pineapple comes from the organic compound, $CH_3CHCOOCH_2CH_3$.
It can be made using the reaction scheme below.



Which row correctly identifies X and Z?

	X	Z
A	CH_3CH_2OH	CH_3CH_2OH
B	CH_3CH_2COOH	CH_3CH_2OH
C	CH_3CH_2OH	CH_3CH_2COOH
D	$CH_3CH_2CH_2OH$	CH_3CH_2OH

34 Which pair of substances are possible products when 1 mole of C_8H_{18} undergoes cracking in the presence of aluminium oxide and silicon dioxide?

1 2 mole of C_4H_8 only

2 1 mole of C_2H_4 and 1 mole of C_6H_{14}

3 1 mole of C_3H_6 and 2 mole of H_2

4 3 mole of CO_2 and 4 mole of H_2O

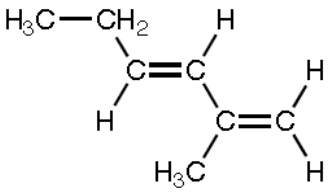
A 1, 3 and 4 only

B 1 and 4 only

C 1 only

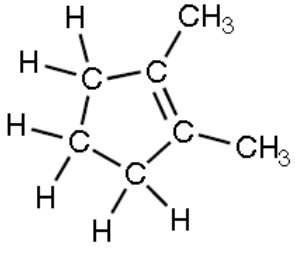
D 2 only

35 The diagram shows a long-chain molecule.

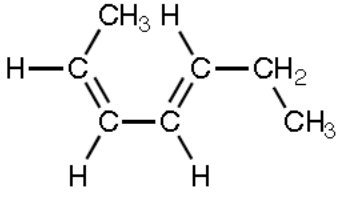


Which structure is **not** an isomer of the molecule?

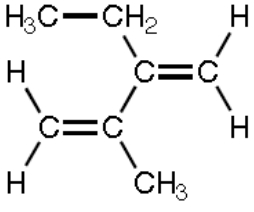
A



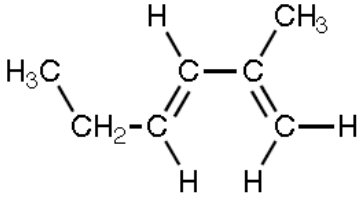
B



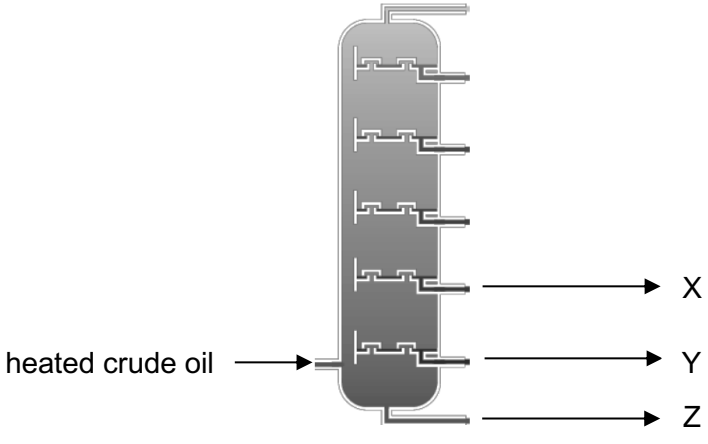
C



D



36 The diagram below shows the fractional distillation of crude oil.



Which statement is correct?

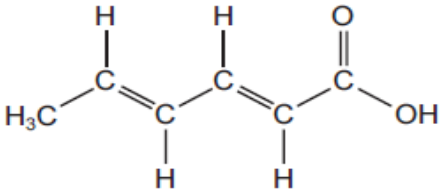
A Fraction X is used as fuel for cooking.

B Fractions X, Y and Z are each obtained as mixture of hydrocarbons.

C Fraction Y is more flammable than fraction X.

D Fraction Z has the lowest boiling point of the three fractions.

37 Sorbic acid is used as a food preservative because it kills fungi and moulds.



sorbic acid

Which are the reaction(s) that sorbic acid can undergo?

1 decolourises bromine in an organic solvent

2 reacts with aqueous sodium carbonate to produce carbon dioxide

3 reacts with hydrogen in the presence of a nickel catalyst

A 1 only

B 1 and 2 only

C 1 and 3 only

D all of the above

38 Three beakers contain the following acid solutions.

beaker A	50 cm^3 1.00 mol/dm^3 dilute hydrochloric acid
beaker B	50 cm^3 1.00 mol/dm^3 dilute sulfuric acid
beaker C	50 cm^3 1.00 mol/dm^3 ethanoic acid

A 10 cm length of magnesium is added to each beaker. The magnesium reacted completely in each case.

Each reaction produced 100% yield of the products.

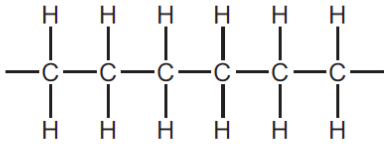
It was observed that 100 cm^3 hydrogen gas was formed when the magnesium reacted with dilute hydrochloric acid.

Which row shows the correct observations when beakers B and C were compared with beaker A?

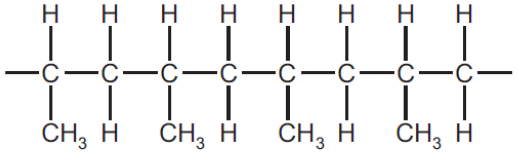
	speed of reaction		volume of hydrogen formed at the end of the reaction	
	beaker B	beaker C	beaker B	beaker C
A	faster	slower	more	less
B	faster	slower	same	same
C	slower	faster	more	less
D	slower	faster	same	same

39 What is the partial structure of the polymer formed by the polymerisation of propene, $CH_3CH=CH_2$?

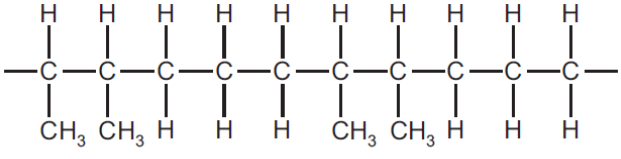
A



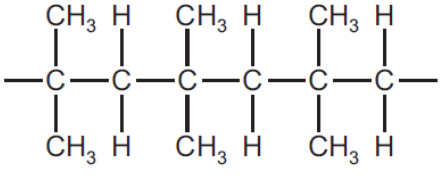
B



C



D



40 Which bond is present in both nylon and *Terylene*?

A C – O

B C = O

C N – C

D N – H

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key: proton (atomic) number / atomic symbol / name / relative atomic mass									5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
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
actinoids	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 –

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