

JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
Secondary 4 Express



STUDENT
NAME

CLASS

INDEX
NUMBER

CHEMISTRY

6092/01

Paper 1 Multiple Choice

26 August 2022

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class and index number in the spaces on all the work you hand in.

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 Multiple Choice 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 15.

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

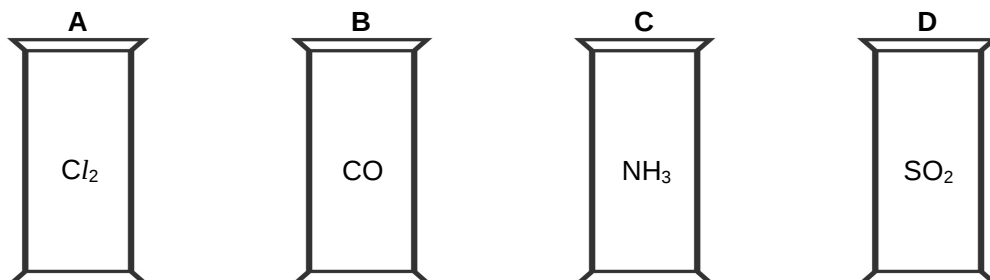
DO NOT OPEN THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

Setter: Mrs Wong Yan Pure

- 1 Four identical gas jars are filled with different gases.

The lids are taken off the gas jars and they are left open to the air for a few hours.

Which gas jar will first contain the most air in it?



- 2 A pale green solution X gives a green precipitate with excess aqueous sodium hydroxide.

An alkaline gas is only given off when the mixture is warmed with powdered aluminium.

Which ions does X contain?

- A** ammonium and copper(II) ions
B ammonium and iron(II) ions
C copper(II) and nitrate ions
D iron(II) and nitrate ions
- 3 Which apparatus **cannot** be used to measure the rate of neutralisation between solid sodium carbonate and aqueous hydrochloric acid?

- | | |
|-----------------------------|----------------------|
| A electronic balance | B gas syringe |
| C stopwatch | D thermometer |

- 4 An analysis is carried out on a plant extract containing some coloured pigments.

In Fig. 4.1, a small amount of plant extract is dotted on a chromatography paper and separated using solvent A.

After drying the chromatography paper, the chromatography paper is subjected to another separation using solvent B, as shown in Fig. 4.2.

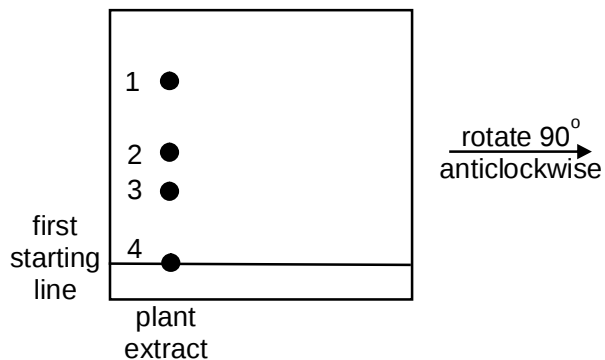


Fig. 4.1

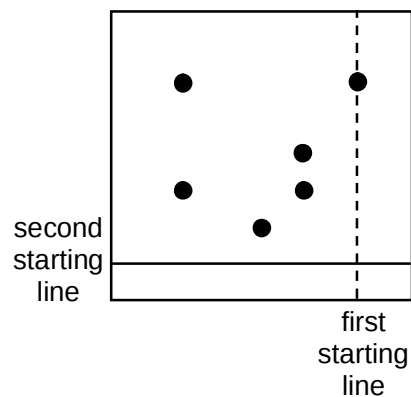


Fig. 4.2

Which statement is **not** true?

- A Pigment 2 is less soluble in solvent A than in solvent B.
- B Pigment 4 is most likely a pure substance.
- C Pigments 1 and 3 have a same substance.
- D The components in pigment 1 have different solubilities in solvent B.

- 5 An ion X^+ contains 23 nucleons and 10 electrons.

What does the nucleus of the ion X^+ contain?

	protons	neutrons
A	9	14
B	10	13
C	11	11
D	11	12

- 6 A covalent compound has the following structural formula.



Which row shows the possible electronic structures of the atoms X, Y and Z?

	X	Y	Z
A	1	2,2	2,5
B	1	2,4	2,3
C	2,8,7	2,2	2,3
D	2,8,7	2,4	2,5

- 7 Peeling onions often cause tearing of the eyes due to the release of a sulfide compound.

Peeling them under running water reduces the problem.

Which statements are true of the sulfide compound?

- 1 It has a low boiling point.
- 2 It has small and light ions with weak bonding.
- 3 It is a covalent compound with weak covalent bonds.
- 4 It is soluble in water.

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

- 8 The strongest ionic crystal lattices are generally observed to consist of highly charged ions combined in a 1 : 1 ratio.

Which two elements are likely to form crystals with the highest melting point?

- | | |
|-------------------------------|-------------------------------|
| A aluminium and oxygen | B calcium and fluorine |
| C lithium and fluorine | D magnesium and oxygen |

- 9 Sulfur vapour with a mass of 128 g has the same volume as 16 g of oxygen at the same temperature and pressure.

What is the formula of a molecule of sulfur vapour?

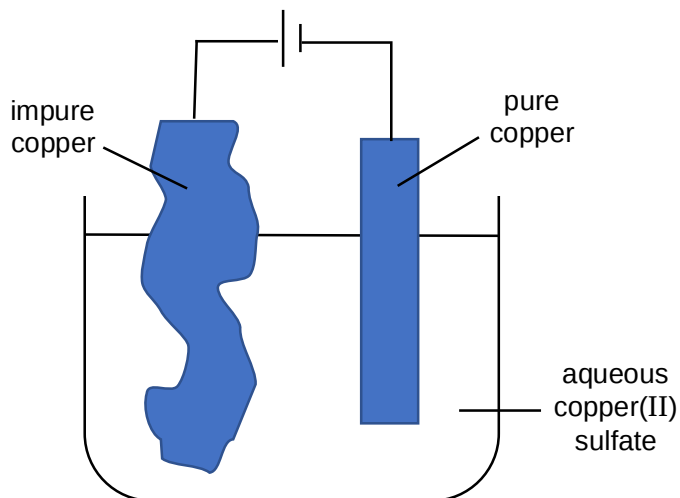
- | | |
|-------------------------|-------------------------|
| A S ₂ | B S ₄ |
| C S ₆ | D S ₈ |

- 10** 75 cm³ of 0.200 mol / dm³ of sodium hydroxide is added to 25 cm³ of 0.200 mol / dm³ sulfuric acid.

What is the concentration of the excess sodium hydroxide in the resultant solution?

- A** 0.005 mol / dm³ **B** 0.010 mol / dm³
C 0.030 mol / dm³ **D** 0.050 mol / dm³

- 11** A student carried out an electrolytic purification of copper as shown.



The table shows the information about this electrolytic purification.

mass of	before electrolytic purification / g	after electrolytic purification / g
anode	100	10
cathode	10	80

What was the percentage impurity of the impure copper anode?

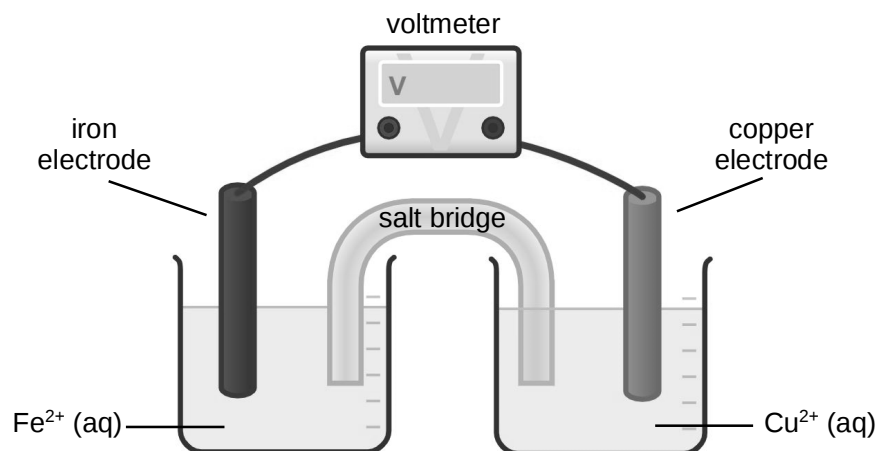
- A** 10.0 % **B** 20.0 %
C 30.0 % **D** 90.0 %

- 12** When gold plating an orchid, a coating containing fine metal or carbon particles is first painted onto the orchid.

Why is this coating applied?

- A** It allows the gold to form a tough alloy on the orchid's surface.
B It gives the orchid a conductive surface so that it can act as the anode.
C It gives the orchid a conductive surface so that it can act as the cathode.
D It gives the orchid a sticky surface so that the gold plating will not fall off.

- 13 Which observation will be made when dilute sulfuric acid is electrolysed using graphite electrodes?
- A No gas is evolved at both the cathode and anode.
- B The gas evolved at the anode extinguishes a lighted splint with a 'pop' sound.
- C The gas evolved at the cathode is less dense than air.
- D The gas evolved at the cathode relights a glowing splint.
- 14 The figure shows the set-up of a simple cell involving iron and copper electrodes immersed in their respective electrolytes.



Which statement is **not** true for the experiment?

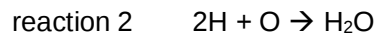
- A The colour intensity of copper(II) solution decreases over time.
- B The electrons flow from left to right through the salt bridge.
- C There is a decrease in the mass of iron electrode.
- D There is an increase in the mass of copper electrode.
- 15 The table shows the energy released by the complete combustion of some compounds used as fuels.

compound	formula	M_r	$\Delta H / \text{kJ} / \text{mol}$
methane	CH_4	16	-880
ethanol	$\text{C}_2\text{H}_5\text{OH}$	46	-1380
propane	C_3H_8	44	-220
heptane	C_7H_{16}	100	-4800

Which fuel produces the most energy when 1 g of the compound is completely burnt?

- A methane
- B ethanol
- C propane
- D heptane

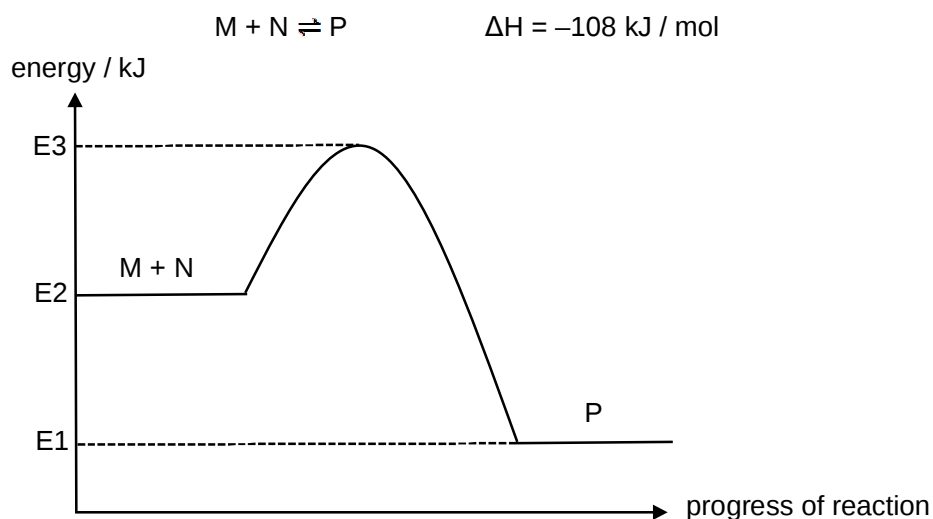
- 16** The equations for three reactions are given.



Which of these reactions are endothermic?

- | | | | |
|----------|------------------------|----------|------------------------|
| A | reaction 1 only | B | reactions 1 and 2 only |
| C | reactions 1 and 3 only | D | reactions 2 and 3 only |

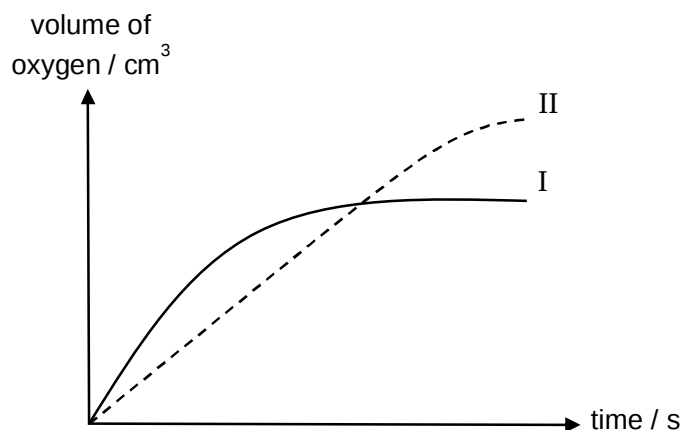
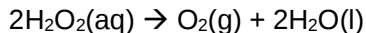
- 17** The energy profile diagram for the following reaction is shown.



Which equation represents the activation energy of the forward reaction?

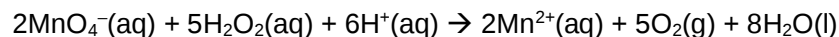
- | | | | |
|----------|-------------------------|----------|-------------------------|
| A | $\text{E1} + \text{E2}$ | B | $\text{E2} - \text{E1}$ |
| C | $\text{E3} - \text{E1}$ | D | $\text{E3} - \text{E2}$ |

- 18 Curve I is obtained by the decomposition of 50 cm³ of 1 mol / dm³ aqueous hydrogen peroxide, catalysed by manganese(IV) oxide.



Which change will produce curve II?

- A adding 60 cm³ of 1 mol / dm³ aqueous hydrogen peroxide
 - B adding 100 cm³ of 0.1 mol / dm³ aqueous hydrogen peroxide
 - C lowering the temperature
 - D using 75 cm³ of 0.5 mol / dm³ aqueous hydrogen peroxide instead
- 19 Which observation is that of a redox reaction?
- A Aqueous potassium iodide turns brown when chlorine gas is bubbled into it.
 - B Blue precipitate is formed when aqueous ammonia is added to copper(II) nitrate solution.
 - C Bubbles of gas are observed when an acid reacted with solid magnesium carbonate.
 - D Solution turned blue when copper(II) sulfate crystals are added to hydrochloric acid.
- 20 When acidified aqueous hydrogen peroxide is added to aqueous potassium manganate(VII), the reaction takes place:



Which statement about the reaction is correct?

- A Hydrogen peroxide acts as an oxidising agent.
- B The oxidation number of manganese changes from +7 to +2.
- C The potassium manganate(VII) is oxidised.
- D The potassium manganate(VII) solution turns green.

21 Which salt can only be prepared by titration method?

- A aluminium sulfate B ammonium sulfate
C copper(II) sulfate D iron(II) sulfate

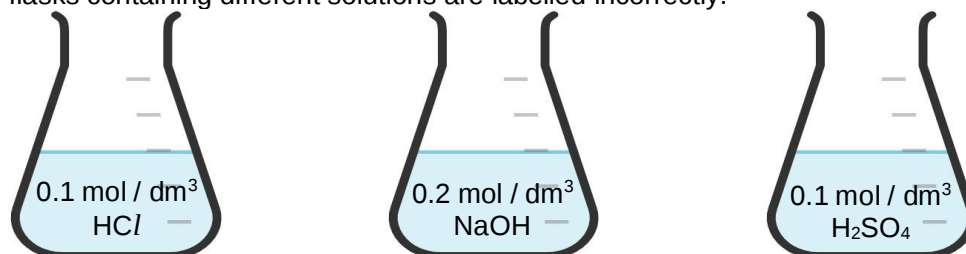
22 Freshly distilled water has a pH of 7.0.

After it was left standing for a short time, the pH was observed to have dropped below 7.0.

Which of the equations best explains the phenomenon?

- A $\text{HCl(aq)} \rightleftharpoons \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq})$
B $\text{H}_2\text{O(l)} \rightleftharpoons \text{H}^+(\text{aq}) + \text{OH}^-(\text{aq})$
C $\text{H}_2\text{O(l)} + \text{CO}_2(\text{g}) \rightleftharpoons 2\text{H}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq})$
D $\text{H}_2\text{O(l)} + \text{NH}_3(\text{g}) \rightleftharpoons \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$

23 Three flasks containing different solutions are labelled incorrectly.



In order to identify the solutions, a student mixes two of the solutions at one time and recording the change in temperature.

Which row shows an **incorrect** explanation to the student's observation?

	observation	explanation
A	There is no change in temperature when two solutions are mixed.	The solutions could be hydrochloric acid and sodium hydroxide respectively.
B	There is no change in temperature when two solutions are mixed.	The solutions could be hydrochloric acid and sulfuric acid respectively.
C	There is temperature rise when two solutions are mixed.	The solutions could be hydrochloric acid and sodium hydroxide respectively.
D	There is temperature rise when two solutions are mixed.	The solutions could be sulfuric acid and sodium hydroxide respectively.

A	NaGeO_3	B	Na_4Ge
C	GeH_4	D	GeO_2

A Group VII elements are coloured.

B The atomic radii of elements increases down the group.

C The density of alkali metals decreases down the group.

D The metallic nature of the elements increases down the group.

	density / g / cm ³	melting point / °C	number of chlorides
A	0.07	−259	1
B	3.10	−7	2
C	2.07	113	1
D	8.92	1083	2

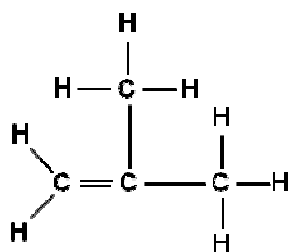
A heating a mixture of metal Q and oxide of metal P
B heating carbonate of Q strongly
C passing hydrogen over the heated oxide of metal P
D passing steam over the heated oxide of metal P

A atomic sizes **B** densities
C electrical conductivities **D** relative atomic masses

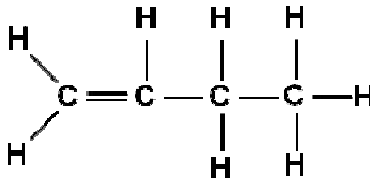


- [Turn over**

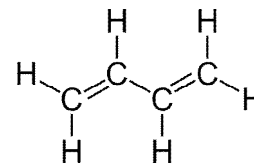
- 33 Structures of three hydrocarbons are shown.



hydrocarbon 1



hydrocarbon 2



hydrocarbon 3

Which statements about these hydrocarbons are correct?

- 1 On complete combustion of one mole of each hydrocarbon, they give the same volume of carbon dioxide.
- 2 They all form addition compounds with bromine.
- 3 They are all isomers of the same hydrocarbon.

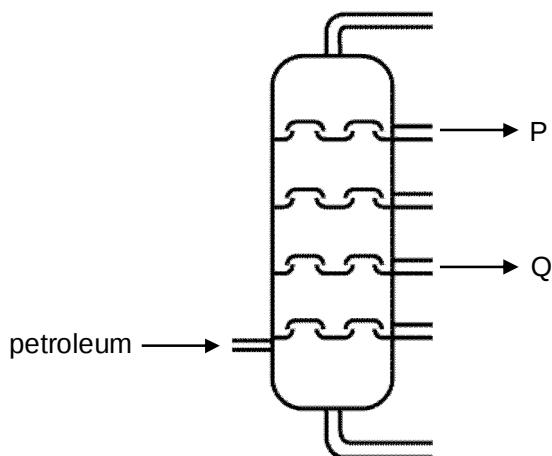
A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

- 34 The diagram shows the separation of crude oil into fractions.



Which statement about fractions P and Q is correct?

A P and Q are mainly alkenes.

B P and Q boil at a fixed temperature.

C P can be cracked to meet the higher demands of Q.

D P has a lower boiling point and a higher flammability than Q.

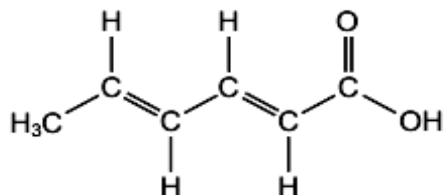
- 35 A food chemist wants to create the odour of pineapples in a product.

An ester with this odour has the formula $\text{C}_3\text{H}_7\text{COOC}_2\text{H}_5$.

Which pair of reactants would produce this ester?

- A** CH_3COOH and $\text{C}_3\text{H}_7\text{OH}$ **B** $\text{C}_2\text{H}_5\text{COOH}$ and $\text{C}_2\text{H}_5\text{OH}$
C $\text{C}_2\text{H}_5\text{COOH}$ and $\text{C}_3\text{H}_7\text{OH}$ **D** $\text{C}_3\text{H}_7\text{COOH}$ and $\text{C}_2\text{H}_5\text{OH}$

- 36 Sorbic acid is used as a food preservative as it kills fungi and moulds that would possibly grow on food.



Sorbic acid will react with

- bromine in an organic solvent.
- Hydrogen at 200°C in the presence of nickel catalyst.

How many moles of bromine and hydrogen will be incorporated into one mole of sorbic acid in these reactions?

	moles of bromine	moles of hydrogen
A	2	2
B	2	3
C	2.5	2
D	2.5	3

- 37 Which property does **not** change when ethene is polymerised to form poly(ethene)?

- A** boiling point **B** melting point
C molecular formula **D** percentage composition of carbon

- 38** Propene reacts with steam at 300 °C in the presence of phosphoric acid as a catalyst to produce a colourless liquid P.

On warming, liquid P with acidified potassium manganate(VII) solution, a colourless liquid Q is produced.

Identify liquids P and Q.

	P	Q
A	propane	butanol
B	propanol	butanoic acid
C	propanol	propanoic acid
D	propyl ethanoate	water

- 39** Polyunsaturated fats are considered healthy fats as they may reduce your risk of heart disease, especially when substituted for saturated fats.

An example of a polyunsaturated fat is $C_{18}H_{32}O_2$.

How many double covalent bonds are present in one molecule of the acid?

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

- 40** In which reaction is water produced?

- A** manufacture of ethanol from ethene
- B** manufacture of margarine from vegetable oils
- C** manufacture of poly(ethene) from ethene
- D** manufacture of Terylene from an alcohol and a carboxylic acid

End of Paper

THE PERIODIC TABLE OF ELEMENTS

Group																	
I	II											III	IV	V	VI	VII	0
																	¹ H hydrogen 1
												⁵ B boron 11	⁶ C carbon 12	⁷ N nitrogen 14	⁸ O oxygen 16	⁹ F fluorine 19	¹⁰ Ne neon 20
³ Li lithium 7	⁴ Be beryllium 9											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
¹¹ Na sodium 23	¹² Mg magnesium 24	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 209	⁸⁵ At astatine 210	⁸⁶ Rn radon 222
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 162	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 any gas is 24 dm³ at room temperature and pressure (r.t.p.)