



CHRIST CHURCH SECONDARY SCHOOL
2022 PRELIMINARY EXAMINATION
FOUR EXPRESS

CANDIDATE
NAME

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CLASS

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CENTRE
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INDEX
NUMBER

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CHEMISTRY

6092/01

Paper 1

15 July 2022

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number, name and class on all the work you hand in.
Write in soft pencil on the Multiple Choice Answer Sheet
Do not use staples, paper clips, highlighters, 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 Multiple Choice Answer Sheet.

Read the instructions on the answer sheet very carefully.

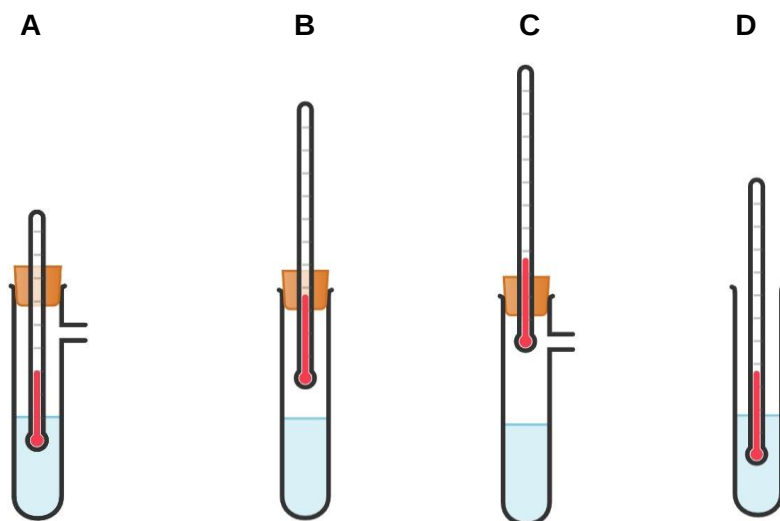
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 14.
The use of an approved scientific calculator is expected, where appropriate.

- 1 Which one of the following correctly describes the particles in a dilute sugar solution at room temperature?

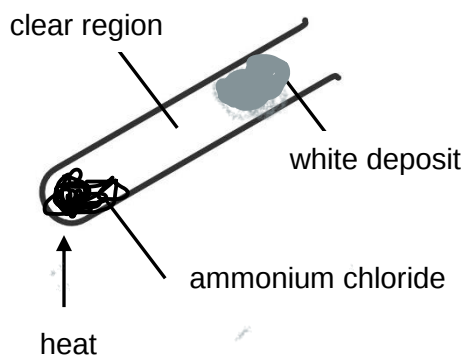
	sugar molecules	water molecules
A	widely separated, moving at random	close together, moving at random
B	widely separated, moving at random	close together, not moving
C	widely separated, not moving	widely separated, moving at random
D	close together, moving at random	widely separated, vibrating slightly

- 2 The tubes shown in the diagram all contain a dilute solution of a solid X dissolved in a liquid Y.

Which apparatus is most suitable for finding the boiling point of liquid Y?



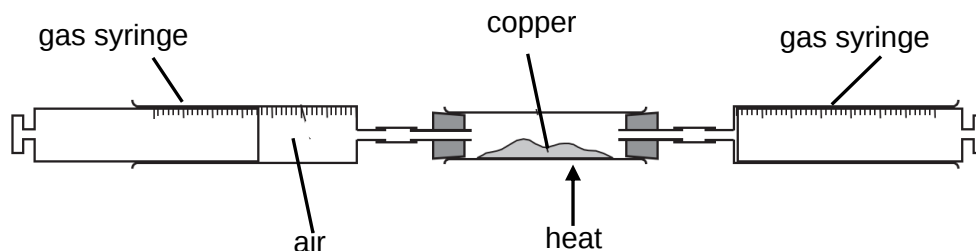
- 3 The diagram shows some ammonium chloride being heated.



What does the clear region between the ammonium chloride and the white deposit contain?

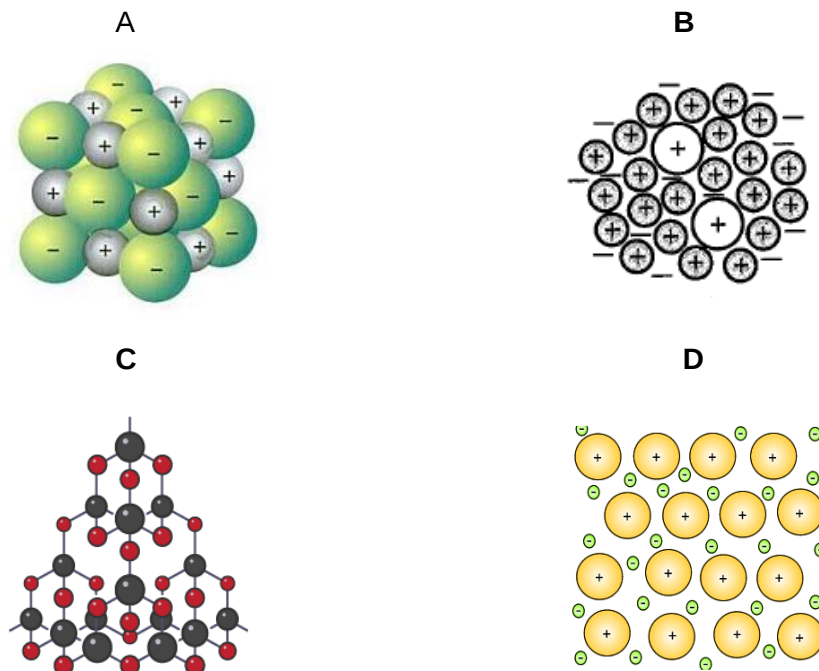
- A ammonia and chlorine
- B ammonia and hydrogen chloride
- C ammonia and water vapour
- D ammonium chloride vapour

- 4 The percentage of oxygen in the air is found by using the apparatus shown below. The air is passed over heated copper until there is no further decrease in volume.



What precaution should be taken before the initial volume of air and final volume of gases remaining in the apparatus are found?

- A The tube containing the copper should be removed.
 - B Both syringes should contain the same volume of air.
 - C All the copper should have reacted.
 - D The apparatus should be at room temperature.
- 5 Which of the following shows the structure of bronze?



- 6 Naturally-occurring bromine has a relative atomic mass of 80 and consists entirely of two isotopes of relative atomic masses 79 and 81.

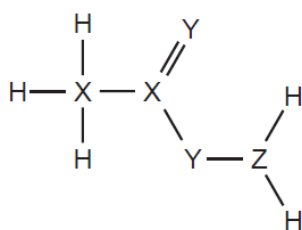
What can be deduced about naturally-occurring bromine from this information only?

- A Bromine is radioactive.
- B Bromine has different oxidation states.
- C Bromine isotopes have different number of protons.
- D Bromine contains the two isotopes in equal proportions.

- 7 Silicon carbide is a shiny, hard, chemically inert material with a very high melting point. It can be used to sharpen knives and make crucibles.

Which type of structure explains these properties?

- A** a giant structure with covalent bonds between carbon and silicon atoms
B a giant structure containing metallic bonds
C a giant structure with covalent bonds between atoms and weak forces of attraction between the layers of atoms
D a simple molecular structure with covalent bonds between the carbon and silicon atoms
- 8 The diagram shows the structure of a covalent compound containing the element hydrogen, H, and the unknown elements X, Y and Z.



To which groups of the Periodic Table do these three elements, X, Y and Z, belong?

	X	Y	Z
A	1	5	6
B	4	5	1
C	4	6	5
D	5	1	4

- 9 What does a solution of hydrogen chloride and methylbenzene contain?
- A** methylbenzene ions, hydrogen ions and chloride ions
B methylbenzene ions and hydrogen chloride molecules
C methylbenzene molecules, hydrogen molecules and chlorine molecules
D methylbenzene molecules and hydrogen chloride molecules
- 10 Which one of the following substances
- (i) is an element
(ii) also forms crystals composed of small molecules?
- A** carbon dioxide
B ice
C iodine
D graphite

- 11** The table below shows the results of experiments to measure the volume of sulfuric acid (column 1) needed to neutralise the mass of sodium hydroxide (column 2) dissolved in the volume of water (column 3).

experiment	column 1	column 2	column 3
	volume of sulfuric acid required / cm ³	mass of sodium hydroxide / g	volume of water required / cm ³
1	20	1	20
2	40	2	40
3	40	2	20
4	?	1	40

From the results, what volume of sulfuric acid is needed to neutralise the sodium hydroxide in experiment 4?

- A** 10 cm³
- B** 20 cm³
- C** 40 cm³
- D** 80 cm³

- 12** Dinitrogen tetroxide, N_2O_4 is a poisonous gas. It can be disposed of safely by reaction with sodium hydroxide. In the experiment, the concentration of aqueous sodium hydroxide used is 1.5 mol/dm^3 .



What is the least volume of aqueous sodium hydroxide required to dispose of 300 cm³ of N₂O₄ at room temperature and pressure?

- A** 10 cm³
- B** 20 cm³
- C** 120 cm³
- D** 240 cm³

- 13** An element X is found in Group VII of the Periodic Table.

Which of the following is a likely behaviour of element X?

- A** reacts vigorously with water
B forms a hydride of formula XH_7
C reduces hydrogen sulfide
D oxidises SO_3^{2-} to SO_4^{2-}

- 14** 250 cm³ of 3.00 mol/dm³ dilute hydrochloric acid is added to 350 cm³ of 2.00 mol/dm³ dilute hydrochloric acid.

What is the concentration of the resulting solution?

- A** 1.45 mol/dm³
B 2.42 mol/dm³
C 2.50 mol/dm³
D 8.33 mol/dm³

- 15** The table below shows the results of heating the carbonates and nitrates of three metals to the same temperature.

metal	products of decomposition	
	metal carbonate	metal nitrate
W	no change	metal nitrite and oxygen
X	oxide and carbon dioxide	metal oxide, nitrogen dioxide and oxygen
Y	no change	metal oxide, nitrogen dioxide and oxygen

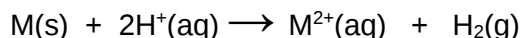
What is the order of these metals in the reactivity series likely to be?

	most reactive	→	least reactive
A	W	X	Y
B	W	Y	X
C	X	Y	W
D	Y	W	X

- 16** Nickel is between iron and lead in the reactivity series.

Which of the following can be deduced from this?

- A** Nickel can be obtained by moderate heating of nickel hydroxide.
B Nickel can displace hydrogen rapidly from hot water.
C Nickel can be displaced from an aqueous solution containing nickel ions.
D Nickel loses electrons more readily than iron
- 17** Which one of the following reactions could be represented by the ionic equation.
M is the symbol for a metallic element.



- A** iron + dilute hydrochloric acid
B lead + dilute sulfuric acid
C iron + steam
D sodium + water
- 18** A sample of air was shaken with an alkaline solution of a compound called pyrogallol. The gases remaining did not support combustion.

Which one of the following pairs of gases was removed by pyrogallol?

- A** carbon dioxide and nitrogen
B oxygen and carbon dioxide
C oxygen and nitrogen
D water vapour and hydrogen

19 Which of the following gases is **least** common in air?

- A hydrogen
- B argon
- C carbon dioxide
- D nitrogen

20 In an experiment, 6 moles of magnesium ions were discharged in the electrolysis of molten magnesium chloride.

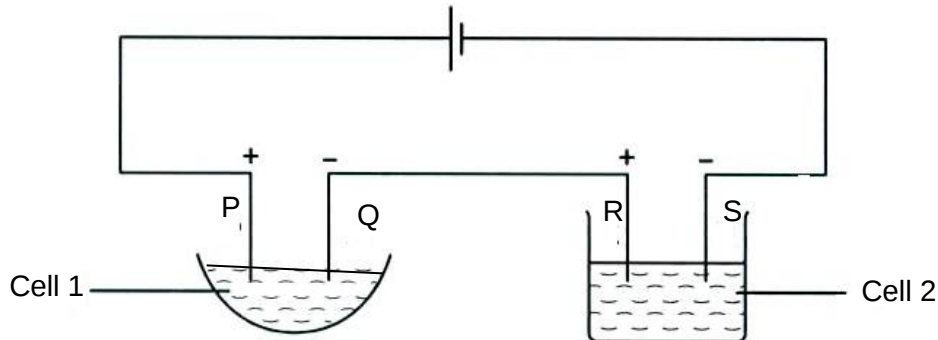
Which amount of metal would be discharged by the same amount of electricity in the following experiments?

- A 3 moles of copper(II) ions in the electrolysis of aqueous copper(II) sulfate.
- B 6 moles of zinc ions in the electrolysis of aqueous zinc chloride.
- C 12 moles of calcium ions in the electrolysis of molten calcium fluoride.
- D 12 moles of lithium ions in the electrolysis of molten lithium bromide.

21 Two electrolytic cells are connected as shown in the diagram.

Cell 1: P is a copper electrode while Q is a platinum electrode immersed in dilute copper(II) chloride solution.

Cell 2: R is a platinum electrode while S is a copper electrode immersed in concentrated copper(II) chloride solution.



Which of the following statement(s) describes the observations made after sometime?

1. There is a higher mass gain in Q than S.
2. Both P and R electrodes decrease in mass.
3. Both Cell 1 and 2 electrolytes fade in colour.

- A 1 and 2
- B 1 and 3
- C 2 and 3
- D none of the above

- 22 When sulfur dioxide is bubbled into aqueous bromine, the reddish brown colour fades.

Which of the following describes the role of sulfur dioxide in the above reaction?

- A an acid
- B an oxidising agent
- C a reducing agent
- D a catalyst

- 23 Which one of the following processes does **not** involve either oxidation or reduction?

- A manufacture of iron from haematite
- B manufacture of ammonium sulfate from ammonia and sulfuric acid
- C manufacture of ammonia from nitrogen and hydrogen
- D manufacture of zinc from zinc blende (ZnS)

- 24 Which one of the following statements is always true for all examples of combustion?

- A One product is always carbon dioxide.
- B It is an exothermic reaction.
- C The combustion products have more energy than the original fuel and oxygen.
- D No bonds are broken in the reaction.

- 25 When powdered metal M was placed in aqueous lead(II) nitrate, a grey precipitate was obtained. The temperature rose and some M remained unchanged.

Which of the following conclusions **cannot** be deduced from this information?

- A The reaction is exothermic.
- B M is more reactive than lead.
- C M was in excess.
- D M has the same valency as lead.

- 26 Hydrogen peroxide decomposes to form water and oxygen gas. In two separate experiments, manganese(VI) oxide was added to 50 cm³ of aqueous hydrogen peroxide.

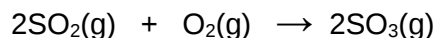
The measurements taken are shown in the table below.

experiment	mass of MnO ₂ / g	temperature rise / °C	Total volume of O ₂ produced / cm ³
1	0.1	5	50
2	0.2	x	y

What were the values of x and y?

	x	y
A	2.5	50
B	5.0	50
C	5.0	100
D	10.0	100

- 27 Sulfur dioxide is reacted with oxygen to produce sulfur trioxide. This reaction is catalysed by a metal oxide catalyst.



What will become larger if the experiment is repeated using a better catalyst?

- A The total volume of gas produced at the end of the reaction.
- B The amount of hydrogen peroxide left over at the end of the reaction.
- C The initial gradient of a graph of total volume of gas produced against time.
- D The time needed to produce a particular volume of gas.

- 28 Four oxides are added separately to aqueous sodium hydroxide.

- 1. aluminium oxide
- 2. carbon dioxide
- 3. copper(II) oxide
- 4. magnesium oxide

Which oxides react with aqueous sodium hydroxide?

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

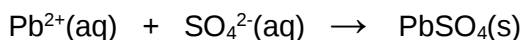
- 29 The results of some tests on solid X are listed below.

- 1. Solid X produced water when it is gently heated alone.
- 2. When dissolved completely in water and added to aqueous ammonia, it gave a dirty-green precipitate.
- 3. When dissolved completely in water and added to silver nitrate solution, it gave a white precipitate.

From the above results, what is solid X?

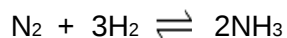
- A hydrated copper(II) sulfate
- B anhydrous copper(II) chloride
- C hydrated iron(II) chloride
- D anhydrous iron(II) sulfate

- 30 Which of the following mixtures below will result in the ionic equation shown?

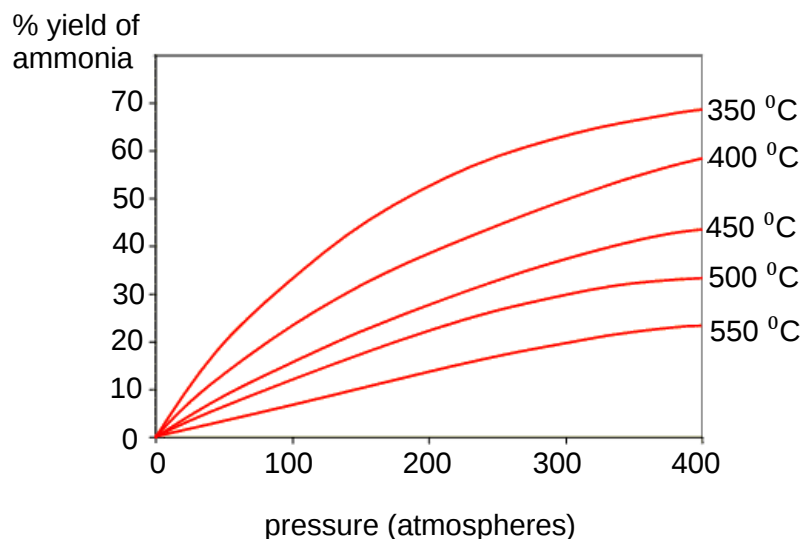


- A aqueous lead(II) nitrate is added to dilute sulfuric acid
- B lead(II) chloride is added to aqueous sodium sulfate
- C lead(II) oxide is added to dilute sulfuric acid
- D lead(II) sulfate is added to water

- 31 Nitrogen and hydrogen can react upon heating, according to the chemical equation.



The graph below shows the percentage yield of ammonia produced from 1 mole of nitrogen at different temperatures and pressures.

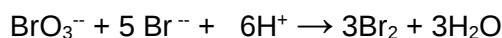


Which of the following statement(s) can be deduced from the information given above?

- At 200 atmospheres, the number of moles of ammonia produced is greater at 450 °C than at 500 °C.
- An increase in pressure increases the number of moles of ammonia produced at both 400 °C and at 350 °C.
- The percentage yield of ammonia will most likely to be 33% at 500 °C and at 400 atmospheres.

- A 1 only
 B 1 and 2 only
 C 2 and 3 only
 D 1, 2 and 3

- 32 The following ionic equation shows a redox reaction.



Which one of the following substances is the oxidising agent?

- A BrO_3^-
 B Br^-
 C H^+
 D H_2O

- 33 Which one of the following reagents can be used to distinguish between butane and butanol?

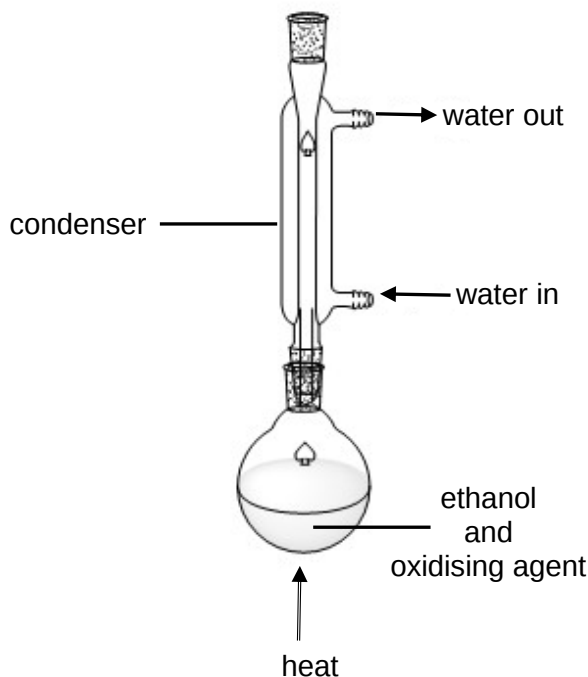
- A concentrated sulfuric acid
 B aqueous bromine
 C phosphoric acid
 D acidified potassium manganate(VII)

- 34 Ethanol is used in some after-shave lotions and deodorants.

Which pair of properties makes it suitable for these uses?

- A It is flammable and mixes easily with water.
- B It is flammable and vapourises easily.
- C It is a good solvent and vapourises easily.
- D It is colourless and mixes easily with water.

- 35 Ethanol was oxidised to ethanoic acid using the apparatus shown below.



What is the purpose of the condenser in the above set-up?

- A prevent the conversion of the ethanol to ethene
 - B prevent the escape of any unchanged ethanol
 - C prevent the reforming of ethanol from ethanoic acid
 - D prevent the reaction of ethanoic acid with ethanol
- 36 Under suitable conditions, concentrated sulfuric acid dehydrates methanoic acid, H_2CO_2 , to give carbon monoxide according to the equation below.



Concentrated sulfuric acid also dehydrates $\text{H}_2\text{C}_2\text{O}_4$. In this case, what product(s), other than water, would you expect to be formed?

- A carbon monoxide only
- B carbon dioxide only
- C carbon monoxide and hydrogen
- D carbon dioxide and carbon monoxide

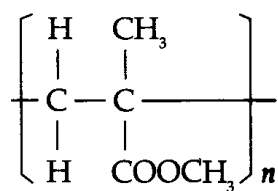
37 Which one of the following correctly describes both ethene and ethane?

- A They are both unsaturated hydrocarbons.
- B They both readily decolourise bromine water.
- C They can both burn to produce carbon dioxide and water.
- D They are both readily polymerised.

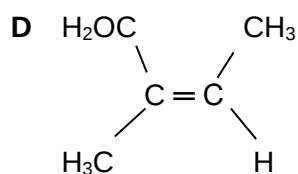
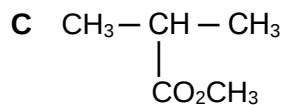
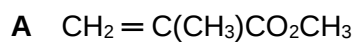
38 In which process do large molecules become smaller molecules?

- A fermentation of sugars
- B catalytic reaction between ethene and steam
- C reaction between ethene and bromine
- D polymerisation of ethene

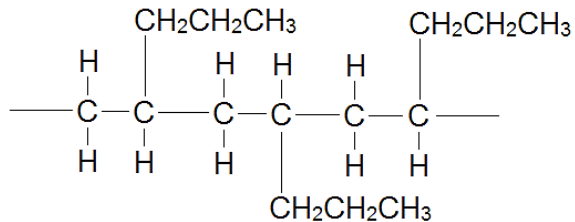
39 The polymer, perspex, has the structural formula.



Which of the following structures is the monomer for the polymer?



- 40 Engine oil is used to lubricate the car engine. Certain polymers are added to engine oil to improve its viscosity. A portion of the chain of one such polymer is shown below.



A molecule of this polymer contains 40 carbon atoms.

How many molecules of monomer are required to form one molecule of this polymer?

- A 4
- B 5
- C 8
- D 10

End of Paper

The Periodic Table of Elements

Group																																																																												
I	II	1 H hydrogen 1										III	IV	V	VI	VII	0																																																											
Key																																																																												
3 Li lithium 7		4 Be beryllium 9		proton (atomic) number atomic symbol name relative atomic mass																																																																								
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 -	118 Og oganesson -

lanthanoids

actinoids

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 -

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).