Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/23**

Paper 2 Multiple Choice (Extended) **October/November 2022**

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

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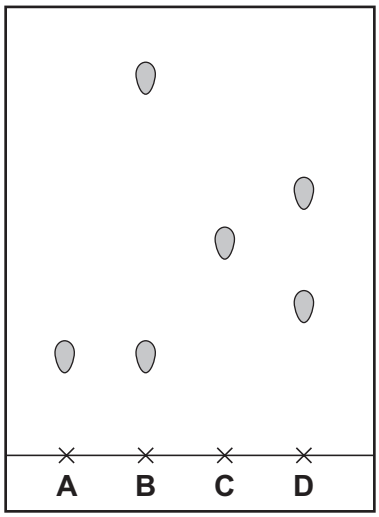
[Turn over

1 Which gas diffuses the most slowly?

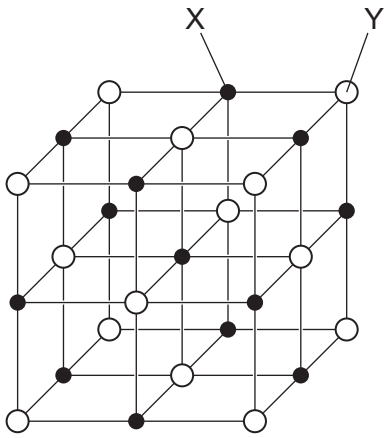
A CH_4 **B** CO_2 **C** H_2 **D** NH_3

2 The chromatogram from four different substances is shown.

Which pure substance has the largest R_f value?



3 The structure of sodium chloride can be represented as shown.



What are X and Y?

	X	Y
A	metal atom	non-metal atom
B	negative ion	electron
C	positive ion	negative ion
D	positive ion	electron

4 Which two particles have the same electronic structure?

A C and O^{2-}

B F^- and Na

C K^+ and S^{2-}

D Mg and Na^+

5 Which statements about isotopes of the same element are correct?

1 They are atoms which have the same chemical properties because they have the same number of electrons in their outer shell.

2 They are atoms which have the same number of electrons and neutrons but different numbers of protons.

3 They are atoms which have the same number of electrons and protons but different numbers of neutrons.

A 1 and 2 **B** 1 and 3 **C** 2 only **D** 3 only

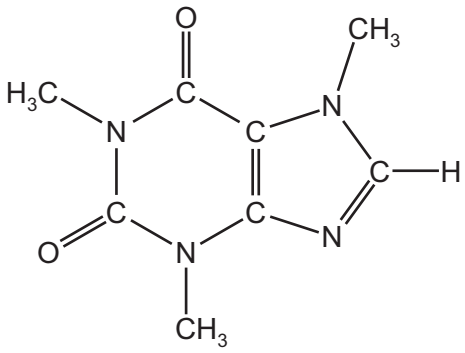
6 What is the total number of shared electrons in a molecule of methanol, CH_3OH?

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

7 Which row about the structures and uses of diamond and graphite is correct?

	structure	use
A	diamond has a giant covalent structure	diamond is used to make electrodes
B	diamond has a simple covalent structure	diamond is used to make cutting tools
C	graphite has a giant covalent structure	graphite is used as a lubricant
D	graphite has a simple covalent structure	graphite is used to make cutting tools

8 Caffeine is a stimulant found in coffee.



caffeine

Which formula represents caffeine?

A $C_7H_{10}N_4O_2$ **B** $C_8H_{10}N_3O_2$ **C** $C_8H_{10}N_4O_2$ **D** $C_8H_{11}N_4O_2$

9 The equation for the reaction between hydrogen sulfide, H_2S, and oxygen is shown.

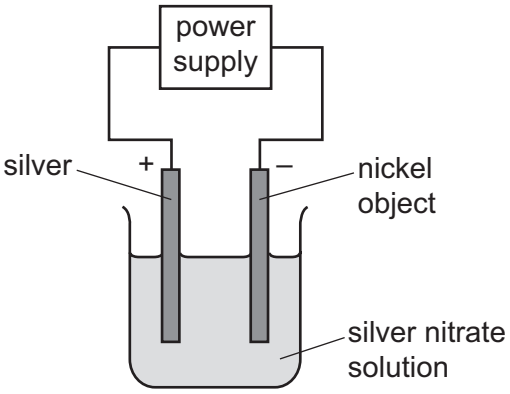
$$2H_2S + 3O_2 \rightarrow 2SO_2 + 2H_2O$$

Which mass of oxygen is required to react with 5.1 g of hydrogen sulfide?

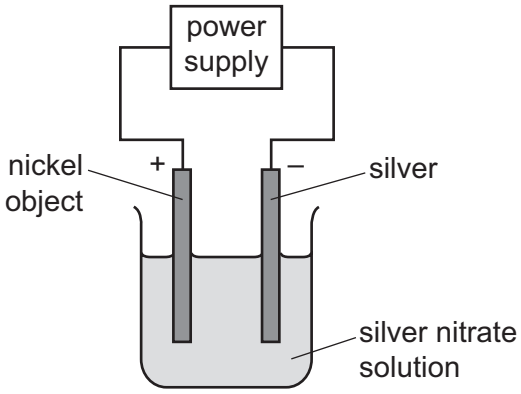
A 2.4 g **B** 4.8 g **C** 7.2 g **D** 14.4 g

10 Which apparatus is used to plate a nickel object with silver?

A



B



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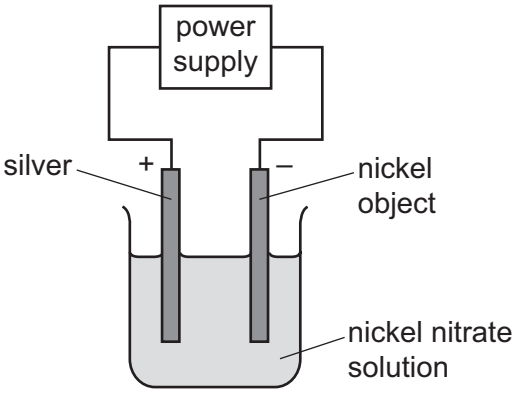
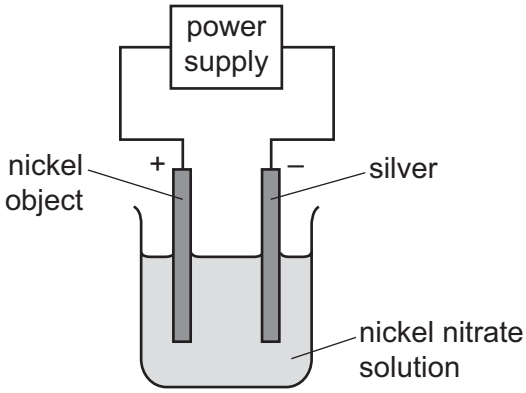


D



11 When an acid is added to an alkali, the temperature of the reaction mixture rises.

Which words describe this reaction?

A decomposition and endothermic

B decomposition and exothermic

C neutralisation and endothermic

D neutralisation and exothermic

12 Some properties of four fuels are shown.

Which fuel is a gas at room temperature and makes two products when it burns in a plentiful supply of air?

	fuel	formula	melting point / °C	boiling point / °C
A	hydrogen	H_2	–259	–253
B	methane	CH_4	–182	–164
C	octane	C_8H_{18}	–57	126
D	wax	$C_{31}H_{64}$	60	400

13 Dinitrogen tetroxide, N_2O_4, is converted into nitrogen dioxide, NO_2, in a reversible reaction.

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

The forward reaction is endothermic.

Which conditions give the highest equilibrium yield of nitrogen dioxide?

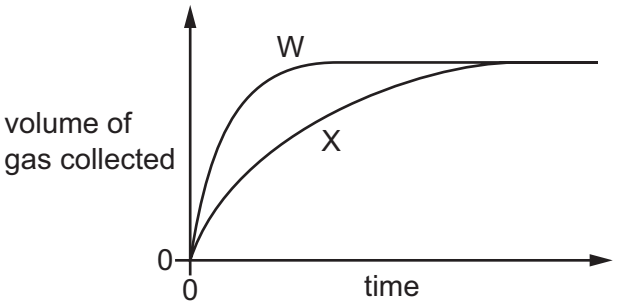
	pressure / atmospheres	temperature
A	2	high
B	2	low
C	50	high
D	50	low

14 Dilute hydrochloric acid is reacted with excess calcium carbonate and the total volume of gas is measured at regular intervals.

The results are shown by line W on the graph.

The experiment is repeated but with one change.

The results of the second experiment are shown by line X on the graph.



Which change is made in the second experiment?

A A catalyst is added.

B The calcium carbonate is broken into smaller pieces.

C The concentration of the dilute hydrochloric acid is increased.

D The temperature of the dilute hydrochloric acid is decreased.

15 When hydrated copper(II) sulfate is heated, it produces white copper(II) sulfate. When water is added, the white copper(II) sulfate turns blue.

Which type of reaction is shown by these observations?

A decomposition

B displacement

C redox

D reversible

16 When magnesium is heated with zinc oxide a reaction occurs.

The equation is shown.

$$Mg + ZnO \rightarrow MgO + Zn$$

Which substance is oxidised?

A magnesium

B magnesium oxide

C zinc

D zinc oxide

17 The equation for the reaction between ethene and hydrogen is shown.

$$CH_2{=}CH_2(g) + H_2(g) \rightarrow CH_3{-}CH_3(g)$$

The bond energies are shown.

bond	bond energy in kJ / mol
C=C	612
H–H	436
C–C	348
C–H	416

What is the overall energy change during this reaction?

A –284 kJ / mol

B –132 kJ / mol

C +132 kJ / mol

D +284 kJ / mol

18 Ethanoic acid reacts with water to produce an acidic solution.

Which row describes the roles of ethanoic acid and water in this reaction?

	ethanoic acid	water
A	accepts a proton	donates a proton
B	accepts an electron	donates an electron
C	donates a proton	accepts a proton
D	donates an electron	accepts an electron

19 Tests are done on an aqueous solution.

test	a few drops of aqueous sodium hydroxide are added	aqueous sodium hydroxide is added in excess
observation	white precipitate	precipitate dissolves to give a colourless solution

Which cations produce these observations?

1 aluminium, Al^{3+}

2 calcium, Ca^{2+}

3 zinc, Zn^{2+}

A 1 and 2 **B** 1 and 3 **C** 1 only **D** 2 and 3

20 Ammonia, NH_3, dissolves in water to form a dilute solution of ammonium hydroxide, NH_4OH.

The reaction is reversible and exists as an equilibrium mixture.

$$NH_3(g) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

Which statement about the mixture is correct?

A All of the ammonia and water molecules have turned into ions.

B The ammonia and water molecules have stopped changing into ions.

C The concentrations of the ammonia molecules and ammonium ions are always equal.

D The rate of the formation of ammonia molecules is equal to the rate of formation of the ammonium ions.

21 Elements E and F are in Group I of the Periodic Table.

E has a higher melting point than F.

Elements J and L are in Group VII of the Periodic Table.

J has a higher density than L.

Which elements have the highest atomic numbers in each group?

A E and J **B** E and L **C** F and J **D** F and L

22 Which metal forms ions with one oxidation state?

A aluminium

B chromium

C copper

D iron

23 How does the nature of the oxides change across Period 3 from sodium to chlorine?

A basic → amphoteric → acidic

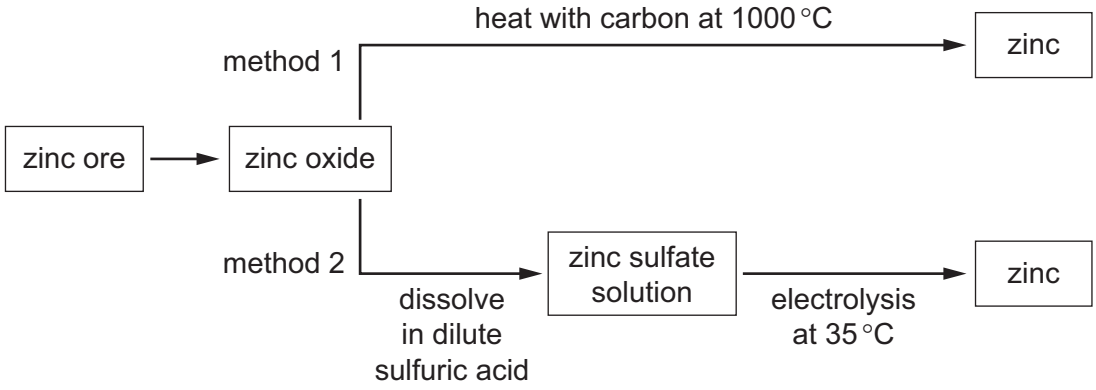
B basic → acidic → amphoteric

C amphoteric → basic → acidic

D acidic → amphoteric → basic

24 Zinc is a metal with a boiling point of 907 °C.

Two methods of making zinc are shown.



Which statement is correct?

A Carbon oxidises zinc oxide in method 1.

B Zinc vapour is produced in both methods.

C Zinc is produced at the anode in method 2.

D Zinc compounds are reduced in both methods.

25 Which statement about the reactions of metals is correct?

A Iron and carbon dioxide are produced when iron(III) oxide is heated with carbon.

B Magnesium reacts with dilute hydrochloric acid producing hydrogen and chlorine.

C Potassium reacts vigorously with water producing hydrogen and an acidic solution.

D Zinc reacts with dilute sulfuric acid producing sulfur dioxide.

26 12.4 g of copper(II) carbonate is heated in a test-tube. Only 50% is decomposed.

[M_r: $CuCO_3$, 124; CuO, 80]

What will be the final mass of the substances in the test-tube?

A 9.4 g **B** 9.8 g **C** 10.2 g **D** 10.6 g

27 Which statement about the manufacture of ammonia is correct?

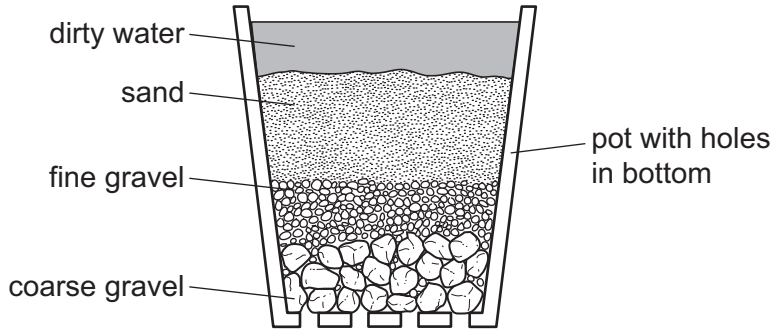
A Ammonia is manufactured by heating hydrogen and nitrogen at 50 °C and 1.0 atm.

B Ammonia is obtained by heating hydrogen and nitrogen in the Contact process.

C Hydrogen for the manufacture of ammonia is extracted from air.

D The reaction between hydrogen and nitrogen to form ammonia is reversible.

28 The diagram shows a stage in the purification of dirty water.



Which process does this apparatus show?

A chlorination

B condensation

C distillation

D filtration

29 Which substance in polluted air damages stonework and kills trees?

A carbon dioxide

B carbon monoxide

C lead compounds

D sulfur dioxide

30 Petrol-fuelled cars produce oxides of nitrogen.

Which statement explains how oxides of nitrogen are formed?

A In the catalytic converter, the elements nitrogen and oxygen combine.

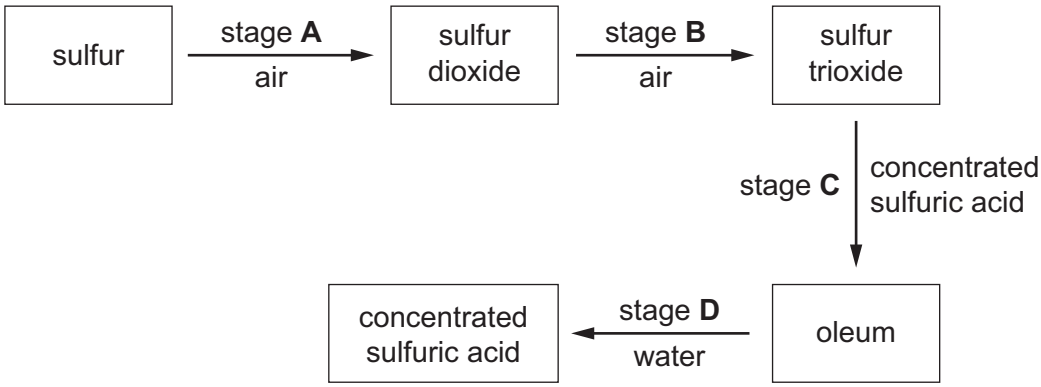
B Oxygen and nitrogen compounds in petrol combine in the car engine.

C The high temperatures in the engine provide oxygen and nitrogen with the activation energy needed to react.

D In the car engine, nitrogen compounds in petrol combine with oxygen.

31 The scheme shows four stages in the conversion of sulfur to sulfuric acid.

In which stage is a catalyst used?



32 Which element has an oxide that is used as a food preservative?

A helium

B hydrogen

C iron

D sulfur

33 Which substance gives off carbon dioxide on heating?

A lime

B limestone

C limewater

D slaked lime

34 Which formula represents ethyl butanoate?

A $CH_3CH_2CH_2COOCH_2CH_3$

B $CH_3COOCH_2CH_2CH_2CH_3$

C $CH_3CH_2CH_2CH_2COOCH_2CH_3$

D $CH_3CH_2COOCH_2CH_2CH_2CH_3$

35 Methanol, CH_3OH, is a member of the homologous series of alcohols.

What is the formula of the alcohol in the same homologous series which contains three carbon atoms?

A C_3H_5OH **B** C_3H_6OH **C** C_3H_7OH **D** C_3H_8OH

36 Which type of compound reacts with hydrogen in an addition reaction?

A alkanes

B alkenes

C alcohols

D carboxylic acids

37 The equation for the reaction between methane and chlorine is shown.

$$CH_4 + 4Cl_2 \rightarrow CCl_4 + 4HCl$$

Which type of reaction does methane undergo?

A substitution

B reduction

C condensation

D addition

38 Which functional groups form an amide linkage?

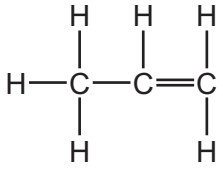
A $H_2N–$ and –COOH

B $H_2N–$ and $H_2N–$

C –OH and –COOH

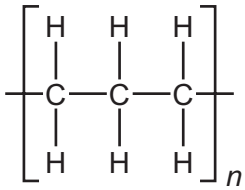
D –OH and $H_2N–$

39 The structure of propene is shown.

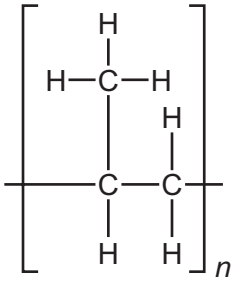


Which diagram represents poly(propene)?

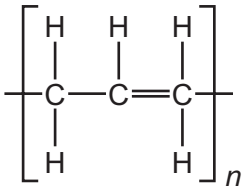
A



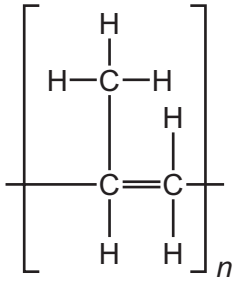
B



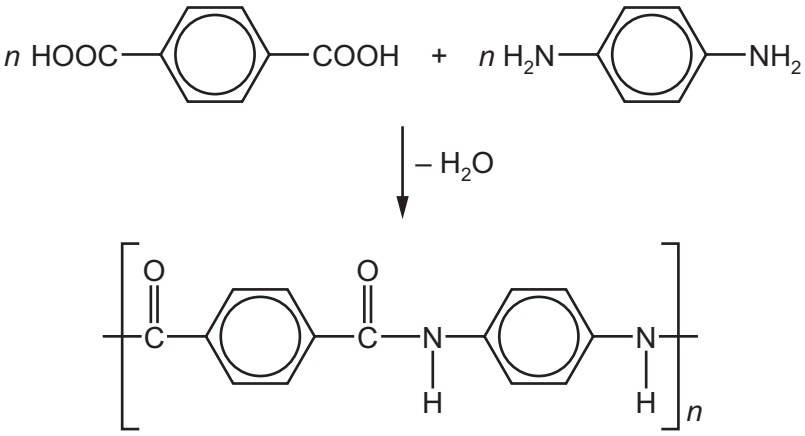
C



D



40 The equation shows the formation of a polymer called *Kevlar*.



Which row describes *Kevlar*?

	how the polymer is formed	type of polymer
A	addition polymerisation	polyamide
B	addition polymerisation	polyester
C	condensation polymerisation	polyamide
D	condensation polymerisation	polyester

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											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 –		

Key

atomic number
atomic symbol
name
relative atomic mass

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.).