



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

**CHEMISTRY**

**0620/22**

Paper 2 Multiple Choice (Extended)

**February/March 2017**

**45 minutes**

Additional Materials:      Multiple Choice Answer Sheet  
   Soft clean eraser  
   Soft pencil (type B or HB is recommended)

\* 2 7 2 1 7 4 1 0 1 7 \*

**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.  
Do not use staples, paper clips, glue or correction fluid.  
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.  
**DO NOT WRITE IN ANY BARCODES.**

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.

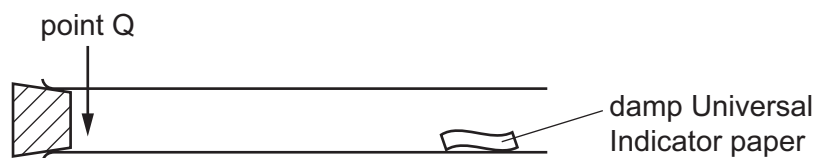
**Read the instructions on the Answer Sheet very carefully.**

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 16.  
Electronic calculators may be used.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **16** printed pages.

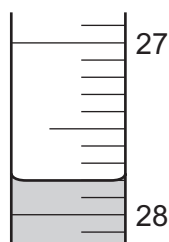
- 1 A gas is released at point Q in the apparatus shown.



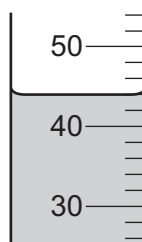
Which gas changes the colour of the damp Universal Indicator paper most quickly?

	gas	relative molecular mass
<b>A</b>	ammonia	17
<b>B</b>	carbon dioxide	44
<b>C</b>	chlorine	71
<b>D</b>	hydrogen	2

- 2 The diagrams show liquids in a burette and a measuring cylinder.



burette

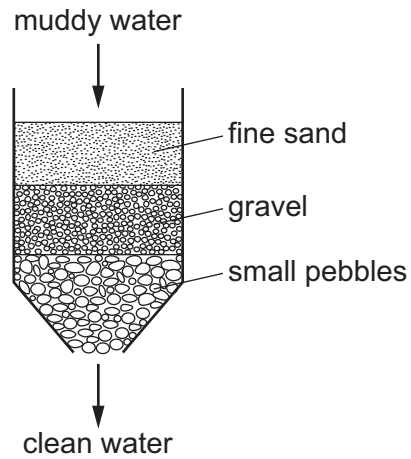


measuring cylinder

Which row shows the correct readings for the burette and the measuring cylinder?

	burette	measuring cylinder
<b>A</b>	27.8	42
<b>B</b>	27.8	44
<b>C</b>	28.2	42
<b>D</b>	28.2	44

- 3 The diagram shows how muddy water can be purified.



Which process for purifying the muddy water is shown?

- A crystallisation
  - B distillation
  - C filtration
  - D solvent extraction
- 4 Which statement explains why isotopes of an element have the same chemical properties?
- A They have different numbers of neutrons.
  - B They have the same number of electrons as protons.
  - C They have the same number of electrons in the outer shell.
  - D They have the same number of protons in the nucleus.

5 The formulae of some ions are shown.

positive ions	negative ions
$Al^{3+}$	$Br^{-}$
$Ca^{2+}$	$CO_3^{2-}$
$Cu^{2+}$	$NO_3^{-}$
$Fe^{3+}$	$S^{2-}$
$K^{+}$	$SO_4^{2-}$

In which row is the formula **not** correct?

	compound	formula
<b>A</b>	aluminium sulfate	$Al_2(SO_4)_3$
<b>B</b>	calcium nitrate	$Ca(NO_3)_2$
<b>C</b>	iron(III) bromide	$Fe_3Br$
<b>D</b>	potassium sulfide	$K_2S$

6 Diamond and silicon(IV) oxide both have giant structures.

Which statements are correct?

- 1 Both substances are compounds.
- 2 There are strong covalent bonds in diamond.
- 3 Silicon(IV) oxide is bonded ionically.
- 4 Both substances have very high melting points.

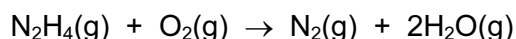
**A** 1 and 2      **B** 2 and 3      **C** 2 and 4      **D** 3 and 4

7 Which statement about metals is correct?

- A** Layers of positive ions can slide over each other making metals malleable.
- B** Metallic bonding consists of a lattice of negative ions in a sea of delocalised electrons.
- C** Metallic bonding consists of a lattice of positive ions in a sea of delocalised negative ions.
- D** Metals conduct electricity because positive ions are free to move.

- 8 The gas hydrazine has the molecular formula  $\text{N}_2\text{H}_4$ .

Hydrazine burns in air to form nitrogen gas and steam.



Which statements are correct?

- 1 1 mole of hydrazine gives  $72 \text{ dm}^3$  of gaseous products when it reacts with oxygen at room temperature and pressure.
- 2 The empirical formula of hydrazine is  $\text{NH}_2$ .
- 3 The total number of atoms in 1 mole of hydrazine is  $6 \times$  the Avogadro constant.
- 4 The volume of 1 mole of hydrazine at room temperature and pressure is  $6 \times 24 \text{ dm}^3$ .

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

- 9 Copper(II) carbonate is broken down by heating to form copper(II) oxide and carbon dioxide gas.

The equation for the reaction is shown.



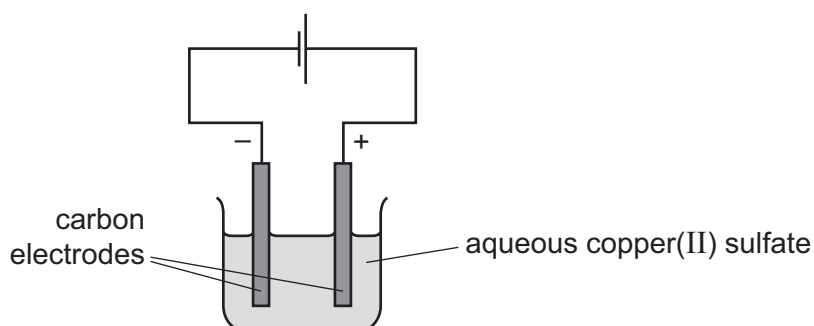
31.0 g of copper(II) carbonate are heated until all of the contents of the test-tube have turned from green to black.

The yield of copper(II) oxide formed is 17.5 g.

What is the percentage yield?

**A** 19.02%      **B** 21.88%      **C** 56.50%      **D** 87.50%

- 10 The diagram shows the electrolysis of aqueous copper(II) sulfate.



Which statement is correct?

- A** Copper metal is deposited at the positive electrode.
- B** In the external circuit the electrons move from positive to negative.
- C** In the solution the electrons move from negative to positive.
- D** Oxygen gas is produced at the positive electrode.

11 Four solutions are separately electrolysed.

experiment	solution	electrodes
1	dilute aqueous sodium chloride	carbon
2	aqueous copper(II) sulfate	copper
3	concentrated hydrochloric acid	carbon
4	dilute sulfuric acid	carbon

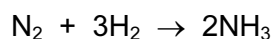
In which two experiments is a colourless gas evolved at the anode?

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

12 Ammonia is made by reacting nitrogen with hydrogen in the presence of an iron catalyst.

The reaction is exothermic.

The equation for the reaction is shown.



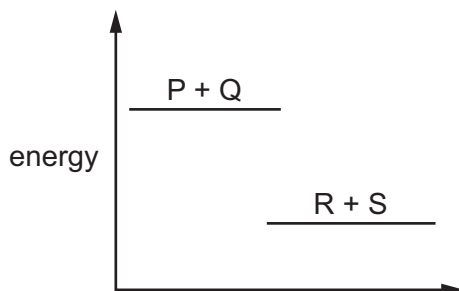
The bond energies are shown in the table.

bond	bond energy in kJ/mol
H–H	436
N–H	390
N≡N	945

What is the energy given out during this reaction?

- A** –4593 kJ/mol    **B** –1083 kJ/mol    **C** –959 kJ/mol    **D** –87 kJ/mol

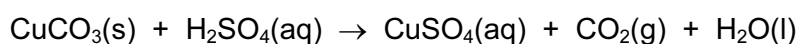
13 The energy level diagram for the reaction between P and Q to form R and S is shown.



Which row describes the energy changes involved and the type of reaction?

	energy changes involved	type of reaction
<b>A</b>	more energy is given out when the bonds in the products are formed than is needed to break the bonds in the reactants	endothermic
<b>B</b>	more energy is given out when the bonds in the products are formed than is needed to break the bonds in the reactants	exothermic
<b>C</b>	more energy is needed to break the bonds in the reactants than is given out when the bonds in the products are formed	endothermic
<b>D</b>	more energy is needed to break the bonds in the reactants than is given out when the bonds in the products are formed	exothermic

14 Copper(II) carbonate reacts with dilute sulfuric acid.



The rate of the reaction can be changed by varying the conditions.

Which changes always increase the rate of this chemical reaction?

- 1 increasing the concentration of sulfuric acid
- 2 increasing the size of the pieces of copper(II) carbonate
- 3 increasing the temperature
- 4 increasing the volume of sulfuric acid

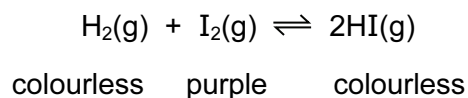
**A** 1, 3 and 4      **B** 1 and 3 only      **C** 2 and 3      **D** 3 and 4 only

15 Which reaction is **not** affected by the presence of light?

- A** a candle burning
- B** methane reacting with chlorine
- C** photosynthesis
- D** silver bromide decomposing to form silver

- 16 The equation for the reversible reaction between hydrogen and iodine to form hydrogen iodide is shown.

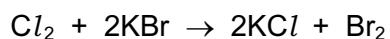
The colours of the reactants and products are shown.



The forward reaction is exothermic.

Which statement is correct?

- A An increase in pressure has no effect on the equilibrium position.
  - B The purple colour fades when the reaction mixture is heated.
  - C When equilibrium is reached, both forward and reverse reactions stop.
  - D When more hydrogen gas is added, the purple colour increases.
- 17 Chlorine displaces bromine from a solution of potassium bromide.



What is the oxidising agent in this reaction?

- A bromide ions
  - B bromine
  - C chloride ions
  - D chlorine
- 18 Beryllium oxide reacts with both sulfuric acid and aqueous sodium hydroxide.

Which type of oxide is beryllium oxide?

- A acidic
- B amphoteric
- C basic
- D neutral



**19** A student investigates two acids W and X.

The same volumes of W and X are reacted separately with excess magnesium.

The student makes the following observations.

- 1 Hydrogen gas is produced at a faster rate with W than with X.
- 2 The total volume of hydrogen gas produced is the same for both acids.

Which statement explains these observations?

- A** The pH of W is higher than the pH of X.
- B** W is an organic acid.
- C** W is a stronger acid than X.
- D** W is more concentrated than X.

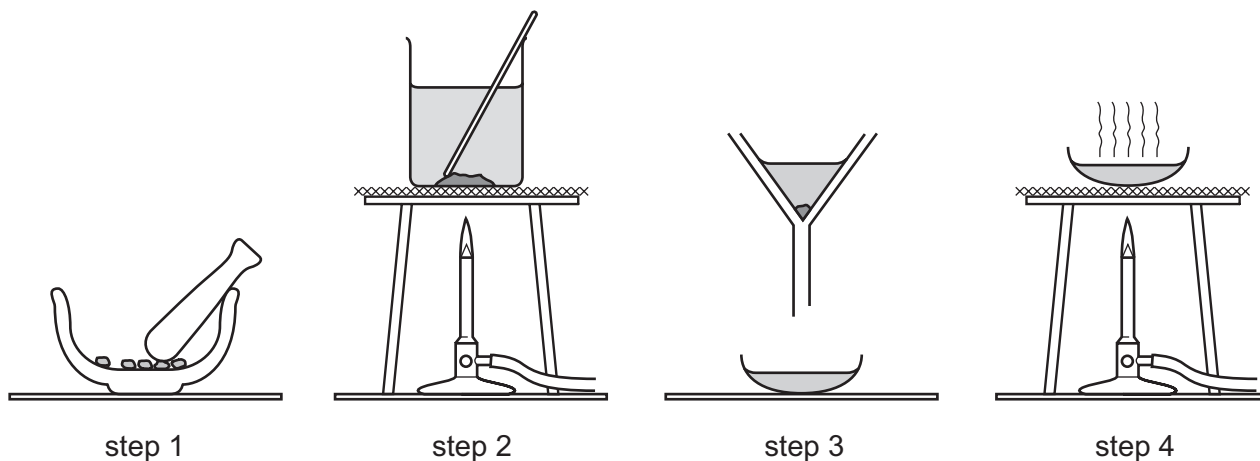
**20** A student is given an unknown solution.

Which two tests provide evidence that the solution is copper(II) sulfate?

- 1 adding dilute hydrochloric acid
- 2 adding aqueous sodium hydroxide
- 3 adding dilute nitric acid, then silver nitrate solution
- 4 adding dilute nitric acid, then barium nitrate solution

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

21 The diagram shows the steps in the preparation of a salt.



Which salt is prepared by this method?

- A barium sulfate
- B copper(II) sulfate
- C potassium sulfate
- D sodium sulfate

22 Which property of elements increases across a period of the Periodic Table?

- A metallic character
- B number of electron shells
- C number of outer shell electrons
- D tendency to form positive ions

23 Magnesium, calcium, strontium and barium are Group II elements.

Group II elements follow the same trends as Group I elements.

Which statements about Group II elements are correct?

- 1 Calcium reacts faster than magnesium with water.
- 2 Barium reacts less vigorously than magnesium with dilute acid.
- 3 Strontium oxidises in air more slowly than barium.

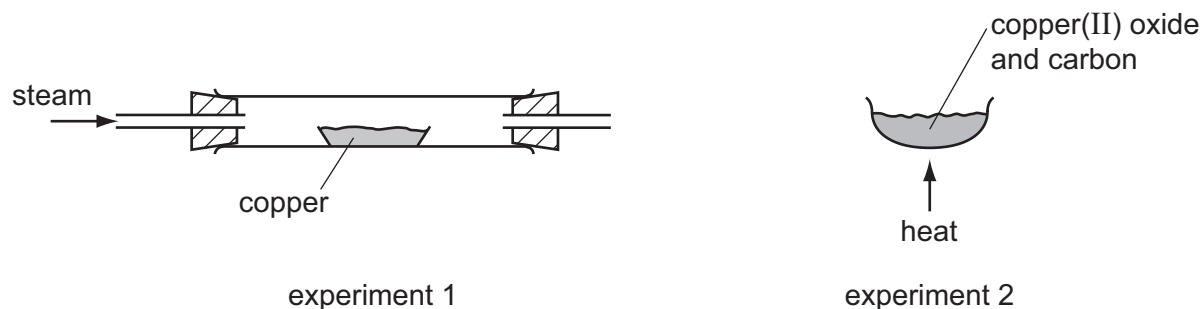
- A 1, 2 and 3
- B 1 and 2 only
- C 1 and 3 only
- D 2 and 3 only



29 Two experiments are carried out.

In experiment 1, copper is heated with steam.

In experiment 2, copper(II) oxide is heated with carbon.



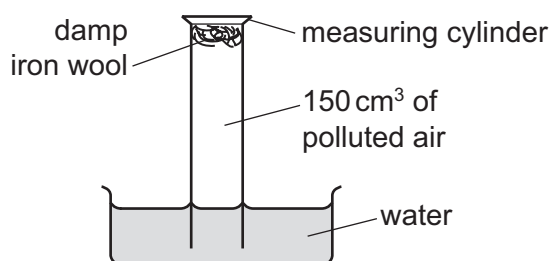
Which row describes what happens in experiments 1 and 2?

	experiment 1	experiment 2
<b>A</b>	no reaction	no reaction
<b>B</b>	no reaction	reaction
<b>C</b>	reaction	no reaction
<b>D</b>	reaction	reaction

30 Which two gases are obtained from liquid air by fractional distillation?

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

31 An experiment to find the percentage of oxygen in  $150\text{ cm}^3$  of polluted air is shown.



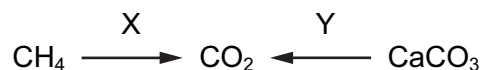
The apparatus is left for one week.

After this time, the volume of gas in the measuring cylinder is  $122\text{ cm}^3$ .

What is the percentage of oxygen, to the nearest whole number, in the polluted air?

- A** 19%
- B** 21%
- C** 28%
- D** 81%

32 Two reactions, X and Y, produce carbon dioxide.



Which types of reaction are X and Y?

	X	Y
<b>A</b>	combustion	combustion
<b>B</b>	combustion	thermal decomposition
<b>C</b>	thermal decomposition	combustion
<b>D</b>	thermal decomposition	thermal decomposition

33 The ions present in ammonium sulfate are formed from the products of the Contact and Haber processes.

Both of these processes involve the use of a catalyst.

Which row is correct?

	ion	formed from	process	catalyst
<b>A</b>	ammonium	ammonia	Contact	iron
<b>B</b>	ammonium	ammonia	Haber	vanadium(V) oxide
<b>C</b>	sulfate	sulfuric acid	Contact	vanadium(V) oxide
<b>D</b>	sulfate	sulfuric acid	Haber	iron

34 The table shows the composition of four different types of petroleum.

fraction	Arabian Heavy / %	Arabian Light / %	Iranian Heavy / %	North Sea / %
gasoline	18	21	21	23
kerosene	11	15	13	15
diesel oil	18	21	20	24
fuel oil	53	43	46	38

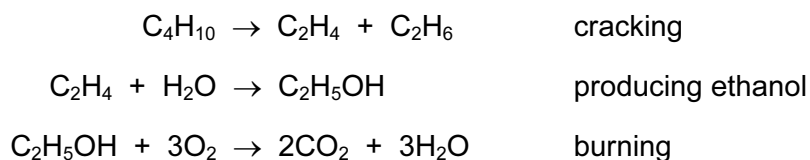
Which type of petroleum is best for the motor vehicle industry?

- A** Arabian Heavy
- B** Arabian Light
- C** Iranian Heavy
- D** North Sea

35 Which reaction of ethene is **not** an addition reaction?

- A reaction with bromine
- B reaction with hydrogen
- C reaction with oxygen
- D reaction with steam

36 Ethanol is a fuel used in cars. It can be made from petroleum.



Compounds of how many homologous series appear in these equations?

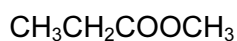
- A 1
- B 2
- C 3
- D 4

37 Ethanol is produced from either ethene or sugar.

Which type of chemical reaction is used in each case?

	ethene → ethanol	sugar → ethanol
<b>A</b>	addition	fermentation
<b>B</b>	addition	fractional distillation
<b>C</b>	distillation	fermentation
<b>D</b>	distillation	fractional distillation

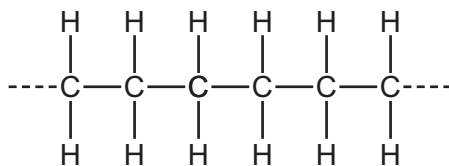
38 The structural formula of an organic compound is shown.



What is the name of this compound?

- A butanoic acid
- B ethyl ethanoate
- C methyl propanoate
- D propyl methanoate

39 The diagram shows the structure of an important product.



This product is formed by ..... 1 ..... of an ..... 2 .....

Which words complete gaps 1 and 2?

	1	2
<b>A</b>	addition polymerisation	alkane
<b>B</b>	addition polymerisation	alkene
<b>C</b>	cracking	alkane
<b>D</b>	cracking	alkene

40 Which pair of compounds reacts to form a condensation polymer?

- A**  $\text{CH}_3\text{COOH}$  and  $\text{C}_2\text{H}_5\text{NH}_2$
- B**  $\text{HCOOH}$  and  $\text{HOC}_2\text{H}_4\text{OH}$
- C**  $\text{HOC}_6\text{H}_{12}\text{OH}$  and  $\text{HOCC}_3\text{H}_6\text{COOH}$
- D**  $\text{H}_2\text{NC}_2\text{H}_4\text{NH}_2$  and  $\text{HOC}_3\text{H}_6\text{OH}$

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## The Periodic Table of Elements

		Group											
I	II	III	IV	V	VI	VII	VIII						
3 <b>Li</b> lithium 7	4 <b>Be</b> beryllium 9	1 <b>H</b> hydrogen 1	5 <b>B</b> boron 11	6 <b>C</b> carbon 12	7 <b>N</b> nitrogen 14	8 <b>O</b> oxygen 16	9 <b>F</b> fluorine 19	10 <b>Ne</b> neon 20					
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> <b>Key</b>            atomic number            atomic symbol            name            relative atomic mass         </div>											
19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40	13 <b>Al</b> aluminium 27	14 <b>Si</b> silicon 28	15 <b>P</b> phosphorus 31	16 <b>S</b> sulfur 32	17 <b>Cl</b> chlorine 35.5	18 <b>Ar</b> argon 40						
37 <b>Rb</b> rubidium 85	38 <b>Sr</b> strontium 88	31 <b>Ga</b> gallium 70	32 <b>Ge</b> germanium 73	33 <b>As</b> arsenic 75	34 <b>Se</b> selenium 79	35 <b>Br</b> bromine 80	36 <b>Kr</b> krypton 84						
55 <b>Cs</b> caesium 133	56 <b>Ba</b> barium 137	30 <b>Zn</b> zinc 65	29 <b>Cu</b> copper 64	47 <b>Ag</b> silver 108	48 <b>Cd</b> cadmium 112	51 <b>Sb</b> antimony 122	52 <b>Te</b> tellurium 128	53 <b>I</b> iodine 127	54 <b>Xe</b> xenon 131				
87 <b>Fr</b> francium —	88 <b>Ra</b> radium —	81 <b>Tl</b> thallium 204	80 <b>Hg</b> mercury 201	79 <b>Au</b> gold 197	82 <b>Pb</b> lead 207	83 <b>Bi</b> bismuth 209	84 <b>Po</b> polonium —	85 <b>At</b> astatine —	86 <b>Rn</b> radon —				
		112 <b>Cn</b> copernicium —	111 <b>Rg</b> roentgenium —	110 <b>Ds</b> darmstadtium —	109 <b>Mt</b> meitnerium —	108 <b>Hs</b> hassium —	107 <b>Bh</b> bohrium —	106 <b>Sg</b> seaborgium —	105 <b>Db</b> dubnium —	104 <b>Rf</b> rutherfordium —	116 <b>Lv</b> livermorium —		

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

lanthanoids

actinoids

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