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

**CHEMISTRY**

**0620/13**

Paper 1 Multiple Choice (Core)

**May/June 2017**

**45 minutes**

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



**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.

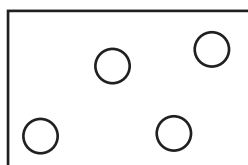
Electronic calculators may be used.

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

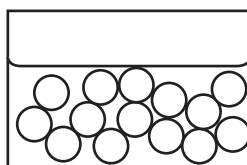
This document consists of **13** printed pages and **3** blank pages.



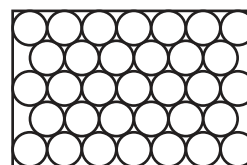
- 1 Diagrams R, S and T represent the three states of matter.



R



S



T

Which change occurs during freezing?

- A**  $R \rightarrow S$       **B**  $S \rightarrow T$       **C**  $T \rightarrow R$       **D**  $T \rightarrow S$

- 2 A student needs to measure  $22 \text{ cm}^3$  of water at  $40^\circ\text{C}$ .

Which apparatus is required?

- A** beaker and stopwatch  
**B** beaker and thermometer  
**C** measuring cylinder and stopwatch  
**D** measuring cylinder and thermometer

- 3 A compound, X, has a melting point of  $71^\circ\text{C}$  and a boiling point of  $375^\circ\text{C}$ .

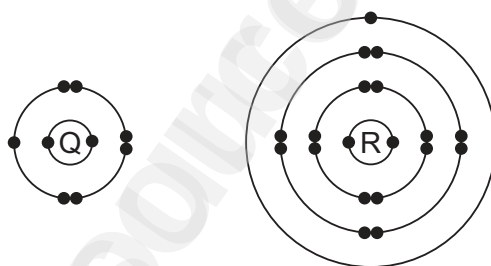
Which statement about X is correct?

- A** It is a liquid at  $52^\circ\text{C}$  and a gas at  $175^\circ\text{C}$ .  
**B** It is a liquid at  $69^\circ\text{C}$  and a gas at  $380^\circ\text{C}$ .  
**C** It is a liquid at  $75^\circ\text{C}$  and a gas at  $350^\circ\text{C}$ .  
**D** It is a liquid at  $80^\circ\text{C}$  and a gas at  $400^\circ\text{C}$ .

- 4 Which method is used to obtain a concentrated solution of ethanol from a dilute solution of ethanol dissolved in water?

- A** crystallisation  
**B** distillation  
**C** filtration  
**D** paper chromatography

- 5 Which definition of isotopes is correct?
- A atoms of the same element that have the same number of electrons and nucleons
  - B atoms of the same element that have the same number of neutrons and protons
  - C atoms of the same element that have the same number of protons but a different number of electrons
  - D atoms of the same element that have the same number of protons but a different number of nucleons
- 6 Which statement about a molecule of ammonia,  $\text{NH}_3$ , is correct?
- A Each hydrogen atom donates a pair of electrons to a nitrogen atom.
  - B There are double covalent bonds between the nitrogen atom and the hydrogen atoms.
  - C There are single covalent bonds between its hydrogen atoms.
  - D There are three shared pairs of electrons in the molecule.
- 7 The electronic structures of atoms Q and R are shown.



Q and R form an ionic compound.

What is the formula of the compound?

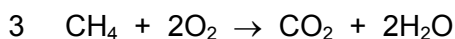
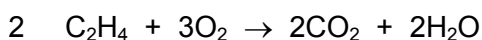
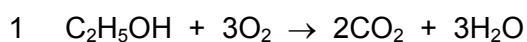
- A  $\text{QR}_7$
  - B  $\text{Q}_2\text{R}_4$
  - C QR
  - D  $\text{Q}_7\text{R}$
- 8 Which substance is a macromolecule?
- A ammonia
  - B carbon dioxide
  - C diamond
  - D water
- 9 What is the relative formula mass of aluminium oxide,  $\text{Al}_2\text{O}_3$ ?
- A 43
  - B 70
  - C 102
  - D 113

- 10 Which products are initially obtained at each electrode during the electrolysis of concentrated aqueous sodium chloride?

|          | cathode  | anode    |
|----------|----------|----------|
| <b>A</b> | hydrogen | chlorine |
| <b>B</b> | hydrogen | oxygen   |
| <b>C</b> | sodium   | chlorine |
| <b>D</b> | sodium   | oxygen   |

- 11 Heat energy is produced when hydrocarbons burn in air.

Which equations represent this statement?



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

- 12 Which statements about exothermic and endothermic reactions are correct?

1 During an exothermic reaction, heat is given out.

2 The temperature of an endothermic reaction goes up because heat is taken in.

3 Burning methane in the air is an exothermic reaction.

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

- 13 Which changes are physical changes?

1 melting ice to form water

2 burning hydrogen to form water

3 adding sodium to water

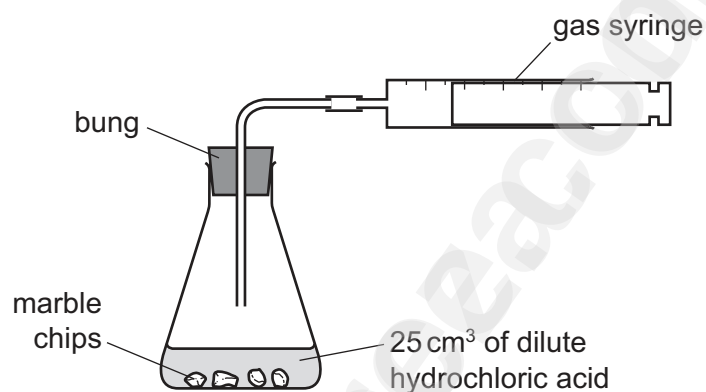
4 boiling water to form steam

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

14 Which colour change is seen when hydrated cobalt(II) chloride is heated so that it becomes anhydrous cobalt(II) chloride?

- A blue to pink
- B blue to white
- C pink to blue
- D white to blue

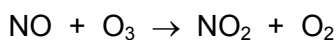
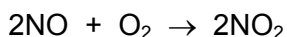
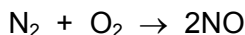
15 A student was investigating the reaction between marble chips and dilute hydrochloric acid.



Which changes slow down the rate of reaction?

|          | temperature of acid | concentration of acid | surface area of marble chips |
|----------|---------------------|-----------------------|------------------------------|
| <b>A</b> | decrease            | decrease              | decrease                     |
| <b>B</b> | decrease            | decrease              | increase                     |
| <b>C</b> | increase            | decrease              | decrease                     |
| <b>D</b> | increase            | increase              | increase                     |

- 16 The reactions shown may occur in the air during a thunder-storm.



Which row shows what happens to the reactant molecules in each of these reactions?

|          | $\text{N}_2$ | $\text{NO}$ | $\text{O}_3$ |
|----------|--------------|-------------|--------------|
| <b>A</b> | oxidised     | oxidised    | oxidised     |
| <b>B</b> | oxidised     | oxidised    | reduced      |
| <b>C</b> | reduced      | reduced     | oxidised     |
| <b>D</b> | reduced      | reduced     | reduced      |

- 17 Three separate experiments are carried out on a solution of substance X.

- 1 A gas is produced when X is heated with ammonium chloride.
- 2 Methyl orange is yellow when added to X.
- 3 There is no reaction between X and sodium carbonate.

Which type of substance is X?

- A** acid
- B** base
- C** indicator
- D** salt

- 18 Farmers spread slaked lime (calcium hydroxide) on their fields to neutralise soils that are too acidic for crops to grow well.

Which ion in slaked lime neutralises the acid in the soil?

- A**  $\text{Ca}^{2+}$       **B**  $\text{H}^+$       **C**  $\text{O}^{2-}$       **D**  $\text{OH}^-$

- 19 Which salt preparation uses a burette and a pipette?

- A** calcium nitrate from calcium carbonate and nitric acid
- B** copper(II) sulfate from copper(II) hydroxide and sulfuric acid
- C** potassium chloride from potassium hydroxide and hydrochloric acid
- D** zinc chloride from zinc and hydrochloric acid

- 20** Aqueous sodium hydroxide reacts with an aqueous solution of compound Y to give a green precipitate.

Aqueous ammonia also reacts with an aqueous solution of compound Y to give a green precipitate.

In each case the precipitate is insoluble when an excess of reagent is added.

Which ion is present in Y?

- A** chromium(III)
- B** copper(II)
- C** iron(II)
- D** iron(III)

- 21** Period 3 of the Periodic Table is shown.

|    |    |    |    |   |   |    |    |
|----|----|----|----|---|---|----|----|
| Na | Mg | Al | Si | P | S | Cl | Ar |
|----|----|----|----|---|---|----|----|

What increases from left to right across Period 3?

- A** density
  - B** melting point
  - C** non-metallic character
  - D** the number of electron shells
- 22** Which element is less reactive than the other members of its group in the Periodic Table?
- A** astatine
  - B** caesium
  - C** fluorine
  - D** rubidium

**23** An element has the following properties.

- It forms coloured compounds.
- It acts as a catalyst.
- It melts at 1539 °C.

In which part of the Periodic Table is the element found?

- A** Group I
- B** Group VII
- C** Group VIII
- D** transition elements

**24** Why are weather balloons sometimes filled with helium rather than hydrogen?

- A** Helium is found in air.
- B** Helium is less dense than hydrogen.
- C** Helium is more dense than hydrogen.
- D** Helium is unreactive.

**25** Element E:

- forms an alloy
- has a basic oxide
- is below hydrogen in the reactivity series.

What is E?

- A** carbon
- B** copper
- C** sulfur
- D** zinc

26 Which row shows how the metal reacts?

|          | metal     | reacts with dilute acid | reacts rapidly with cold water | reacts with steam |
|----------|-----------|-------------------------|--------------------------------|-------------------|
| <b>A</b> | calcium   | x                       | ✓                              | ✓                 |
| <b>B</b> | copper    | ✓                       | x                              | x                 |
| <b>C</b> | magnesium | ✓                       | x                              | ✓                 |
| <b>D</b> | zinc      | ✓                       | x                              | x                 |

27 Which statement about the extraction of iron from hematite is correct?

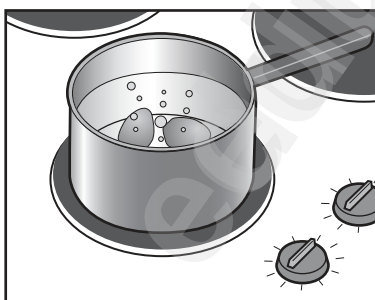
- A** Air is blown into the blast furnace to oxidise the molten iron.
- B** Carbon dioxide is reduced by coke to carbon monoxide.
- C** Hematite is oxidised by carbon to molten iron.
- D** The slag produced is denser than molten iron.

28 Stainless steel is an alloy of iron and other metals. It is strong and does not rust but it costs much more than normal steel.

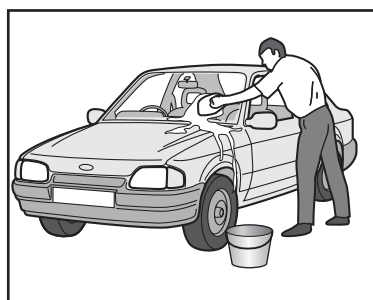
What is **not** made from stainless steel?

- A** cutlery
- B** pipes in a chemical factory
- C** railway lines
- D** saucepans

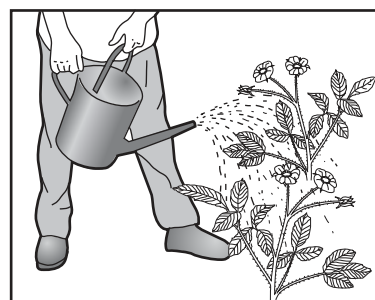
29 The diagram shows some uses of water in the home.



1



2



3

For which uses is it important for the water to have been treated?

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

30 Which pollutant gas **cannot** be produced by the combustion of fossil fuels (coal, petroleum and natural gas)?

- A carbon monoxide
- B methane
- C nitrogen dioxide
- D sulfur dioxide

31 A farmer wrongly adds two substances to the soil at the same time.

They react together to form a gas which turns damp red litmus blue.

What are the two substances?

- A a basic oxide and a potassium salt
- B a basic oxide and an ammonium salt
- C an acidic oxide and a potassium salt
- D an acidic oxide and an ammonium salt

32 In which process is carbon dioxide **not** formed?

- A burning of natural gas
- B fermentation
- C heating lime
- D respiration

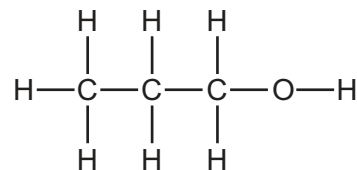
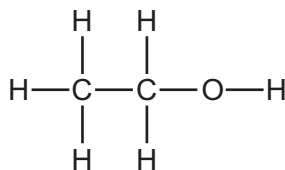
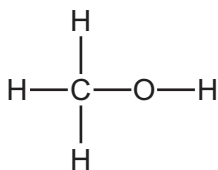
33 Two equations are shown.



Which terms describe reactions 1 and 2?

|   | reaction 1            | reaction 2 |
|---|-----------------------|------------|
| A | reduction             | hydration  |
| B | reduction             | hydrolysis |
| C | thermal decomposition | hydration  |
| D | thermal decomposition | hydrolysis |

34 The structures of three substances are shown.



Why do these substances all belong to the same homologous series?

- A They are all compounds.
- B They are all saturated.
- C They all contain oxygen.
- D They all contain the same functional group.

35 Fuel oil, gasoline, kerosene and naphtha are four fractions obtained from the fractional distillation of petroleum.

What is the order of the boiling points of these fractions?

|   | highest boiling point → lowest boiling point |
|---|----------------------------------------------|
| A | fuel oil → kerosene → gasoline → naphtha     |
| B | fuel oil → kerosene → naphtha → gasoline     |
| C | gasoline → naphtha → kerosene → fuel oil     |
| D | naphtha → gasoline → kerosene → fuel oil     |

36 Which process produces alkenes from alkanes?

- A combustion
- B cracking
- C fermentation
- D polymerisation

37 Poly(ethene) is made from ethene.

Ethene is .....1..... hydrocarbon because it contains a carbon to carbon .....2..... bond.

The general name given to small molecules that undergo polymerisation is .....3..... .

Which words complete gaps 1, 2 and 3?

|          | 1              | 2      | 3        |
|----------|----------------|--------|----------|
| <b>A</b> | an unsaturated | double | monomers |
| <b>B</b> | an unsaturated | single | alkenes  |
| <b>C</b> | a saturated    | double | alkenes  |
| <b>D</b> | a saturated    | single | monomers |

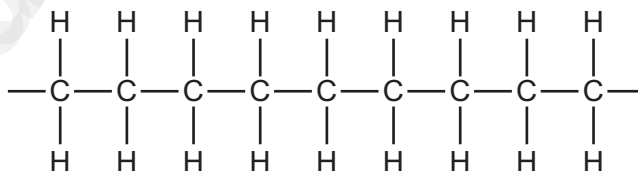
38 Which reaction is used to manufacture ethanol?

- A** reacting ethane with oxygen in the presence of a catalyst
- B** reacting ethane with steam in the presence of a catalyst
- C** reacting ethene with steam in the presence of a catalyst
- D** reacting glucose with steam in the presence of a catalyst

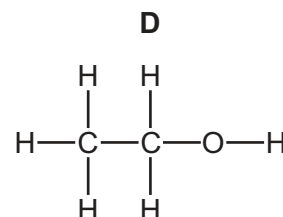
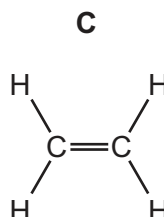
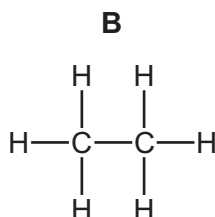
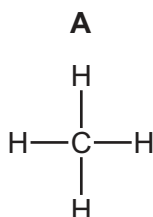
39 Which statement about aqueous ethanoic acid is **not** correct?

- A** It effervesces with sodium carbonate.
- B** It neutralises aqueous sodium hydroxide.
- C** It turns blue litmus from blue to red.
- D** It turns methyl orange from orange to yellow.

40 The diagram shows part of the molecule of a polymer.



Which diagram shows the monomer from which this polymer could be manufactured?



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The Periodic Table of Elements

| Group                      |                             |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               |                             |                             |                             |                               |                              |                             |  |                        |
|----------------------------|-----------------------------|---------------------------------------------------------------------------------------------|---------------------------------|-----------------------------|------------------------------|-----------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|-------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|------------------------------|-----------------------------|--|------------------------|
| I                          | II                          |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               | III                         | IV                          | V                           | VI                            | VII                          | VIII                        |  |                        |
| 3<br>Li<br>lithium<br>7    | 4<br>Be<br>beryllium<br>9   | <div>Key</div> <div>atomic number<br/>atomic symbol<br/>name<br/>relative atomic mass</div> |                                 |                             |                              |                             |                              |                              |                                |                               |                               | 1<br>H<br>hydrogen<br>1     |                             |                             |                               |                              |                             |  | 2<br>He<br>helium<br>4 |
|                            |                             |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               | 5<br>B<br>boron<br>11       | 6<br>C<br>carbon<br>12      | 7<br>N<br>nitrogen<br>14    | 8<br>O<br>oxygen<br>16        | 9<br>F<br>fluorine<br>19     | 10<br>Ne<br>neon<br>20      |  |                        |
| 11<br>Na<br>sodium<br>23   | 12<br>Mg<br>magnesium<br>24 |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               | 13<br>Al<br>aluminium<br>27 | 14<br>Si<br>silicon<br>28   | 15<br>P<br>phosphorus<br>31 | 16<br>S<br>sulfur<br>32       | 17<br>Cl<br>chlorine<br>35.5 | 18<br>Ar<br>argon<br>40     |  |                        |
| 19<br>K<br>potassium<br>39 | 20<br>Ca<br>calcium<br>40   | 21<br>Sc<br>scandium<br>45                                                                  | 22<br>Ti<br>titanium<br>48      | 23<br>V<br>vanadium<br>51   | 24<br>Cr<br>chromium<br>52   | 25<br>Mn<br>manganese<br>55 | 26<br>Fe<br>iron<br>56       | 27<br>Co<br>cobalt<br>59     | 28<br>Ni<br>nickel<br>59       | 29<br>Cu<br>copper<br>64      | 30<br>Zn<br>zinc<br>65        | 31<br>Ga<br>gallium<br>70   | 32<br>Ge<br>germanium<br>73 | 33<br>As<br>arsenic<br>75   | 34<br>Se<br>selenium<br>79    | 35<br>Br<br>bromine<br>80    | 36<br>Kr<br>krypton<br>84   |  |                        |
| 37<br>Rb<br>rubidium<br>85 | 38<br>Sr<br>strontium<br>88 | 39<br>Y<br>yttrium<br>89                                                                    | 40<br>Zr<br>zirconium<br>91     | 41<br>Nb<br>niobium<br>93   | 42<br>Mo<br>molybdenum<br>96 | 43<br>Tc<br>technetium<br>— | 44<br>Ru<br>ruthenium<br>101 | 45<br>Rh<br>rhodium<br>103   | 46<br>Pd<br>palladium<br>106   | 47<br>Ag<br>silver<br>108     | 48<br>Cd<br>cadmium<br>112    | 49<br>In<br>indium<br>115   | 50<br>Sn<br>tin<br>119      | 51<br>Sb<br>antimony<br>122 | 52<br>Te<br>tellurium<br>128  | 53<br>I<br>iodine<br>127     | 54<br>Xe<br>xenon<br>131    |  |                        |
| 55<br>Cs<br>caesium<br>133 | 56<br>Ba<br>barium<br>137   | 57–71<br>lanthanoids                                                                        | 72<br>Hf<br>hafnium<br>178      | 73<br>Ta<br>tantalum<br>181 | 74<br>W<br>tungsten<br>184   | 75<br>Re<br>rhenium<br>186  | 76<br>Os<br>osmium<br>190    | 77<br>Ir<br>iridium<br>192   | 78<br>Pt<br>platinum<br>195    | 79<br>Au<br>gold<br>197       | 80<br>Hg<br>mercury<br>201    | 81<br>Tl<br>thallium<br>204 | 82<br>Pb<br>lead<br>207     | 83<br>Bi<br>bismuth<br>209  | 84<br>Po<br>polonium<br>—     | 85<br>At<br>astatine<br>—    | 86<br>Rn<br>radon<br>—      |  |                        |
| 87<br>Fr<br>francium<br>—  | 88<br>Ra<br>radium<br>—     | 89–103<br>actinoids                                                                         | 104<br>Rf<br>rutherfordium<br>— | 105<br>Db<br>dubnium<br>—   | 106<br>Sg<br>seaborgium<br>— | 107<br>Bh<br>bohrium<br>—   | 108<br>Hs<br>hassium<br>—    | 109<br>Mt<br>meitnerium<br>— | 110<br>Ds<br>darmstadtium<br>— | 111<br>Rg<br>roentgenium<br>— | 112<br>Cn<br>copernicium<br>— | 113<br>Nh<br>nihonium<br>—  | 114<br>Fl<br>flerovium<br>— | 115<br>Mc<br>moscovium<br>— | 116<br>Lv<br>livermorium<br>— | 117<br>Ts<br>tennessine<br>— | 118<br>Og<br>oganesson<br>— |  |                        |

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

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