



# Cambridge IGCSE™

## CHEMISTRY

0620/11

Paper 1 Multiple Choice (Core)

October/November 2020

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. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Blank pages are indicated.



- 1 'The movement of a substance **very slowly** from an area of high concentration to an area of low concentration.'

Which process is being described?

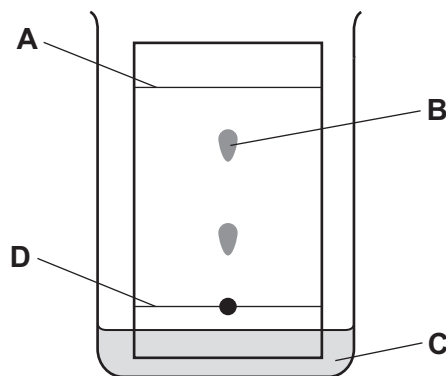
- A a liquid being frozen  
 B a solid melting  
 C a substance diffusing through a liquid  
 D a substance diffusing through the air
- 2 What happens to the average speed of gas particles when pressure and temperature are increased?

|   | average speed of particles |                       |
|---|----------------------------|-----------------------|
|   | pressure increases         | temperature increases |
| A | faster                     | faster                |
| B | unchanged                  | slower                |
| C | slower                     | faster                |
| D | unchanged                  | faster                |

- 3 Which piece of apparatus can only measure a single fixed volume?

- A 250 cm<sup>3</sup> beaker  
 B 50 cm<sup>3</sup> burette  
 C 100 cm<sup>3</sup> measuring cylinder  
 D 25 cm<sup>3</sup> pipette

- 4 In the chromatography experiment shown, which label represents the solvent front?



5 Which substances can be separated by filtration?

- A insoluble liquid and water
- B insoluble solid and water
- C solution of soluble liquid in water
- D solution of soluble solid in water

6 An atom of element R contains 15 protons, 16 neutrons and 15 electrons.

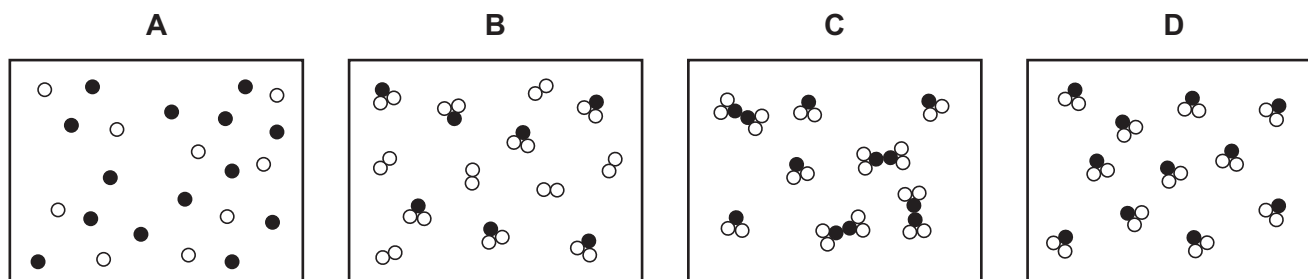
What is R?

- A gallium
- B phosphorus
- C sulfur
- D zinc

7 Which row describes the properties of potassium iodide, KI?

|   | type of bonding | boiling point | solid conducts electricity | aqueous solution conducts electricity |
|---|-----------------|---------------|----------------------------|---------------------------------------|
| A | covalent        | low           | no                         | no                                    |
| B | covalent        | high          | no                         | yes                                   |
| C | ionic           | high          | yes                        | yes                                   |
| D | ionic           | high          | no                         | yes                                   |

8 Which diagram represents a mixture of compounds?



- 9 Rubidium is in Group I of the Periodic Table and bromine is in Group VII.

Rubidium reacts with bromine to form an ionic compound.

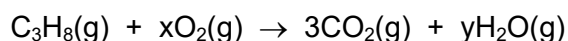
Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?

|          | electron change | formula of ion formed |
|----------|-----------------|-----------------------|
| <b>A</b> | electron gained | $\text{Rb}^+$         |
| <b>B</b> | electron gained | $\text{Rb}^-$         |
| <b>C</b> | electron lost   | $\text{Rb}^+$         |
| <b>D</b> | electron lost   | $\text{Rb}^-$         |

- 10 Which statement explains why graphite is used as a lubricant?

- A** All bonds between the atoms are weak.
- B** It conducts electricity.
- C** It has a low melting point.
- D** Layers in the structure can slide over each other.

- 11 The equation for burning propane in air is shown.



Which values of x and y balance the equation?

|          | x  | y |
|----------|----|---|
| <b>A</b> | 3  | 4 |
| <b>B</b> | 4  | 8 |
| <b>C</b> | 5  | 4 |
| <b>D</b> | 10 | 8 |

- 12 The relative atomic mass of chlorine is 35.5.

When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?

- A** a neutron
- B** a proton
- C** an atom of carbon-12
- D** an atom of hydrogen-1

- 13** Concentrated aqueous sodium chloride is electrolysed using platinum electrodes.

What is the major product formed at each electrode?

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

- 14** Three substances are listed.

- 1 copper
- 2 dilute sulfuric acid
- 3 solid lead(II) bromide

Which substances conduct electricity?

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

- 15** Sodium nitrate is added to water in a beaker and stirred until it dissolves.

At the end of the experiment, the beaker feels cold.

Which row describes the reaction?

|          | temperature of solution | type of reaction |
|----------|-------------------------|------------------|
| <b>A</b> | decreases               | endothermic      |
| <b>B</b> | decreases               | exothermic       |
| <b>C</b> | increases               | endothermic      |
| <b>D</b> | increases               | exothermic       |

- 16** Which substance does **not** require oxygen in order to produce energy?

- A** coal  
**B** hydrogen  
**C** natural gas  
**D**  $^{235}\text{U}$

17 Which process involves a physical change?

- A heating calcium carbonate
- B burning wood
- C melting an ice cube
- D mixing an acid and a base

18 A sign displayed in a flour mill is shown.

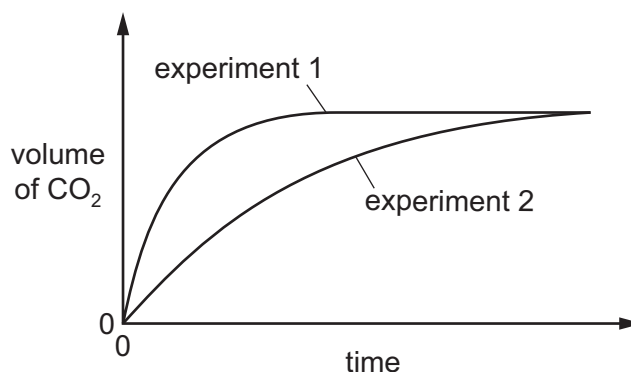


Which statement explains why there is a danger of explosion in a flour mill?

- A Flour burns very quickly because it is a fine powder.
- B Flour is a catalyst for combustion.
- C Flour mills get hot and speed up the rate of combustion.
- D The combustion of flour is exothermic.

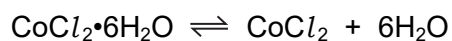
- 19 The graph shows the results of two experiments investigating the rate of reaction between excess calcium carbonate and dilute hydrochloric acid.

In each experiment the volume of carbon dioxide produced is measured at fixed time intervals.



Which statement describes the difference in conditions between experiments 1 and 2?

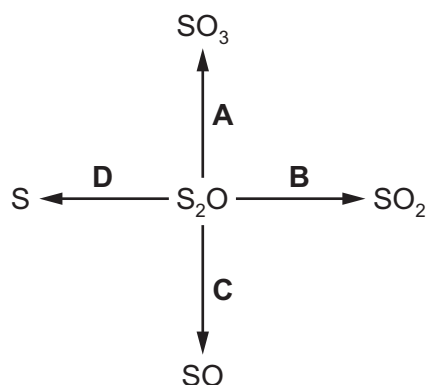
- A In experiment 2 a higher concentration of dilute hydrochloric acid is used.
  - B In experiment 2 a higher temperature is used.
  - C In experiment 2 the mass of calcium carbonate is greater.
  - D In experiment 2 the particle size of calcium carbonate is greater.
- 20 When pink crystals of cobalt(II) chloride are heated, steam is given off and the colour of the solid changes to blue.



What happens when water is added to the blue solid?

|          | colour          | temperature |
|----------|-----------------|-------------|
| <b>A</b> | changes to pink | decreases   |
| <b>B</b> | changes to pink | increases   |
| <b>C</b> | remains blue    | decreases   |
| <b>D</b> | remains blue    | increases   |

21 In which change is the sulfur, S, in sulfur(I) oxide,  $S_2O$ , reduced?



22 What is a characteristic of acids?

- A** Acids turn methyl orange indicator yellow.
- B** Acids have a high pH value.
- C** Acids react with ammonium salts to give ammonia gas.
- D** Acids react with carbonates to produce salts.

23 Four different groups of oxides are shown.

1     $MgO$     $FeO$     $CuO$

2     $CaO$     $SO_2$     $TiO_2$

3     $PbO$     $CaO$     $Cl_2O$

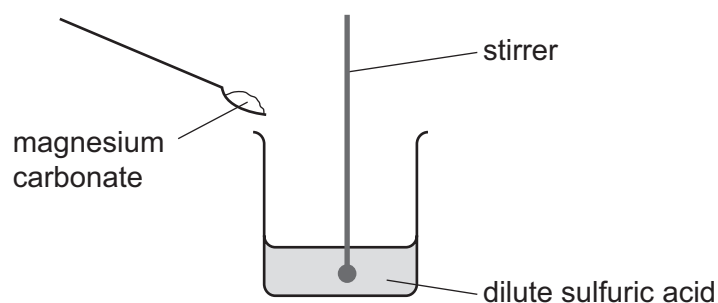
4     $NO_2$     $Br_2O$     $P_2O_5$

Which statement about these oxides is correct?

- A** 1, 2 and 3 contain basic oxides only.
- B** 2, 3 and 4 contain basic oxides only.
- C** 1 contains basic oxides only and 4 contains acidic oxides only.
- D** 1 contains acidic oxides only and 4 contains basic oxides only.

- 24** A student carries out an experiment to prepare pure magnesium sulfate crystals.

The diagram shows the first stage of the preparation.



He adds magnesium carbonate until no more reacts.

Which process should he use for the next stage?

- A** crystallisation  
**B** evaporation  
**C** filtration  
**D** neutralisation

- 25** Which ion produces a green precipitate when aqueous sodium hydroxide is added?

- A**  $\text{Cu}^{2+}$       **B**  $\text{Fe}^{2+}$       **C**  $\text{Fe}^{3+}$       **D**  $\text{Zn}^{2+}$

- 26** The positions of four elements in the Periodic Table are shown.

Which element is a gas that displaces iodine from sodium iodide?

A blank periodic table grid is shown, consisting of 18 columns and 6 rows. The grid is divided into sections by gaps. The first gap is between the first and second columns, spanning rows 1 to 4. The second gap is between the eighth and ninth columns, spanning rows 1 to 4. The third gap is between the fourteenth and fifteenth columns, spanning rows 1 to 4. The fourth gap is between the sixteenth and seventeenth columns, spanning rows 1 to 4. The fifth gap is between the eighteenth and nineteenth columns, spanning rows 1 to 4. The sixth gap is between the first and second columns, spanning rows 5 to 6. The seventh gap is between the eighth and ninth columns, spanning rows 5 to 6. The eighth gap is between the fourteenth and fifteenth columns, spanning rows 5 to 6. The ninth gap is between the sixteenth and seventeenth columns, spanning rows 5 to 6. The tenth gap is between the eighteenth and nineteenth columns, spanning rows 5 to 6. The labels A, B, C, and D are placed in the following positions: A is in the first column, fifth row; B is in the ninth column, sixth row; C is in the fourteenth column, fifth row; D is in the sixteenth column, fifth row.

**27** A flammable gas needs to be removed from a tank at an industrial plant.

For safety reasons, an inert gas is used.

Which gas is suitable?

- A** argon
- B** hydrogen
- C** methane
- D** oxygen

**28** A substance, X, has the following properties.

- 1 It has a high melting point.
- 2 It conducts electricity in the solid and liquid states.
- 3 It is malleable.
- 4 It has a high density.

What is X?

- A** a ceramic
- B** copper
- C** graphite
- D** sodium chloride

29 A reactivity series is shown.

sodium  
calcium  
magnesium  
carbon  
zinc  
iron  
hydrogen  
copper

Which statement is correct?

- A** All the metals above carbon are extracted by electrolysis.
- B** Iron can only be extracted by electrolysis.
- C** Calcium can be extracted by heating calcium oxide with carbon.
- D** Copper can only be extracted by passing hydrogen over heated copper(II) oxide.

30 What is the symbol of the metal used in the manufacture of aircraft because of its strength and low density?

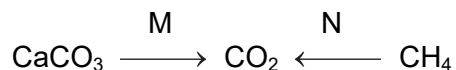
- A** Al                      **B** Cu                      **C** Fe                      **D** Zn

31 Oxides of nitrogen are given out from car exhausts.

Which row best shows why oxides of nitrogen are unwanted in the atmosphere?

|          | acidic | toxic |
|----------|--------|-------|
| <b>A</b> | no     | no    |
| <b>B</b> | no     | yes   |
| <b>C</b> | yes    | no    |
| <b>D</b> | yes    | yes   |

32 Two reactions, M and N, both form carbon dioxide.



Which types of reaction are M and N?

|          | M                     | N                     |
|----------|-----------------------|-----------------------|
| <b>A</b> | thermal decomposition | thermal decomposition |
| <b>B</b> | thermal decomposition | combustion            |
| <b>C</b> | combustion            | thermal decomposition |
| <b>D</b> | combustion            | combustion            |

33 Which row describes two uses of sulfur dioxide?

|          | use 1                         | use 2                                |
|----------|-------------------------------|--------------------------------------|
| <b>A</b> | bleaching paper pulp          | neutralising acidic industrial waste |
| <b>B</b> | bleaching paper pulp          | preserving food and drink            |
| <b>C</b> | extracting iron from hematite | neutralising acidic industrial waste |
| <b>D</b> | extracting iron from hematite | preserving food and drink            |

34 Which statement about lime and limestone is correct?

- A** Calcium oxide is formed from limestone in a displacement reaction.
- B** Lime is used to treat alkaline soils.
- C** Limestone is a waste material in the manufacture of iron.
- D** Slaked lime is used in the process of flue gas desulfurisation.

35 Which compound has a chemical name ending in *-oic acid*?

- A** C<sub>2</sub>H<sub>5</sub>OH
- B** C<sub>2</sub>H<sub>6</sub>
- C** CH<sub>3</sub>COOH
- D** C<sub>2</sub>H<sub>4</sub>

**36** Petroleum is separated into fractions by fractional distillation.

Separation occurs in a fractionating column.

Some properties of three of these fractions are shown.

| fraction | boiling point range / °C | number of carbon atoms in the molecules |
|----------|--------------------------|-----------------------------------------|
| 1        |                          | 5–10                                    |
| 2        | 320–350                  | 16–24                                   |
| 3        | 120–210                  |                                         |

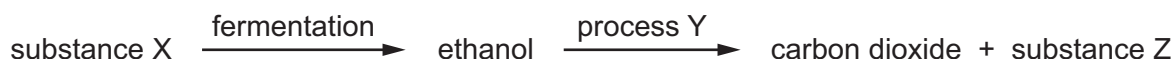
Which statement is correct?

- A** Fraction 1 has a higher boiling point range than fraction 2.
- B** Fraction 2 is removed from a higher point in the fractionating column than fraction 1.
- C** Molecules in fraction 3 have shorter chains than those in fraction 2.
- D** None of the fractions are liquid at room temperature.

**37** Which statement about alkenes is correct?

- A** Alkenes are saturated hydrocarbons.
- B** Alkenes can be made by cracking other hydrocarbon compounds.
- C** Alkenes change bromine water from colourless to brown.
- D** Alkene molecules contain double bonds between carbon atoms and hydrogen atoms.

**38** The flow chart shows the preparation of ethanol and some important chemistry of ethanol.



What are X, Y and Z?

|          | X       | Y              | Z       |
|----------|---------|----------------|---------|
| <b>A</b> | yeast   | combustion     | oxygen  |
| <b>B</b> | glucose | combustion     | steam   |
| <b>C</b> | glucose | polymerisation | water   |
| <b>D</b> | yeast   | fermentation   | glucose |

**39** Which statements about aqueous ethanoic acid are correct?

- 1 It is an alkane.
- 2 It reacts with sodium carbonate to form carbon dioxide.
- 3 It changes the colour of litmus solution from blue to red.
- 4 It is a hydrocarbon.

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

**40** Which substance is a polymer?

- A** diamond
- B** graphite
- C** nylon
- D** sodium chloride

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The Periodic Table of Elements

| Group                      |                             |                                                                                     |                                 |                             |                              |                              |                              |                              |                                |                               |                               |                             |                               |                              |                              |                            |                             |                          |                        |     |      |
|----------------------------|-----------------------------|-------------------------------------------------------------------------------------|---------------------------------|-----------------------------|------------------------------|------------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|-------------------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|----------------------------|-----------------------------|--------------------------|------------------------|-----|------|
| I                          | II                          | 1<br>H<br>hydrogen<br>1                                                             |                                 |                             |                              |                              |                              |                              |                                |                               |                               |                             |                               |                              |                              | III                        | IV                          | V                        | VI                     | VII | VIII |
| 3<br>Li<br>lithium<br>7    | 4<br>Be<br>beryllium<br>9   | Key<br><div>atomic number<br/>atomic symbol<br/>name<br/>relative atomic mass</div> |                                 |                             |                              |                              |                              |                              |                                |                               |                               |                             |                               | 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<br>actinoids                                                   | 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>— | 114<br>Fl<br>flerovium<br>— | 116<br>Lv<br>livermorium<br>— | 118<br>Ts<br>tennessine<br>— | 119<br>Og<br>oganesson<br>—  | 120<br>Nh<br>nihonium<br>— | 122<br>Fl<br>flerovium<br>— |                          |                        |     |      |

|             |  |    |    |           |     |    |    |         |     |    |    |              |     |    |    |           |     |    |    |            |   |    |    |           |     |    |    |           |     |    |    |            |     |    |    |           |     |    |    |             |     |    |    |             |     |     |    |         |     |     |    |             |     |     |    |           |     |     |    |            |     |
|-------------|--|----|----|-----------|-----|----|----|---------|-----|----|----|--------------|-----|----|----|-----------|-----|----|----|------------|---|----|----|-----------|-----|----|----|-----------|-----|----|----|------------|-----|----|----|-----------|-----|----|----|-------------|-----|----|----|-------------|-----|-----|----|---------|-----|-----|----|-------------|-----|-----|----|-----------|-----|-----|----|------------|-----|
| 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 | europtium | 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<sup>3</sup> at room temperature and pressure (r.t.p.).



# Cambridge IGCSE™

## CHEMISTRY

0620/12

Paper 1 Multiple Choice (Core)

October/November 2020

45 minutes

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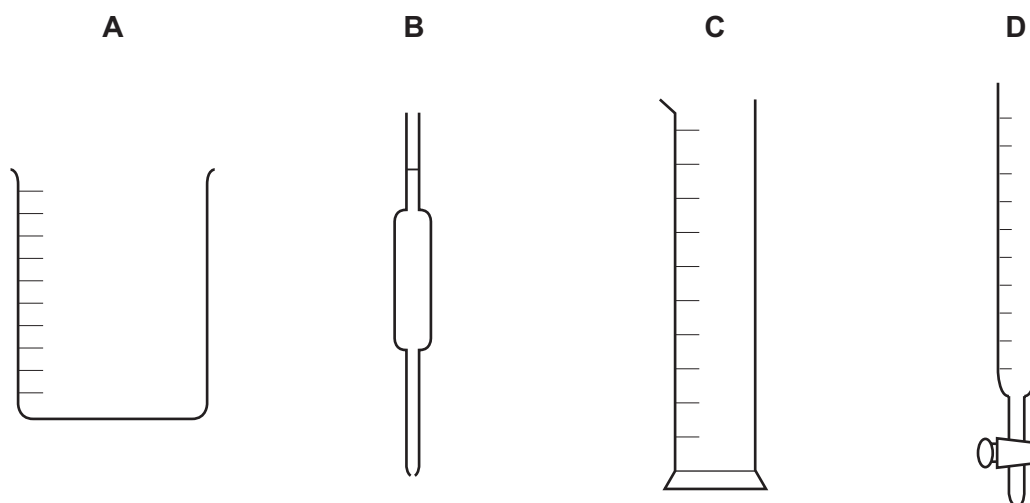
- 1 'The movement of a substance **very slowly** from an area of high concentration to an area of low concentration.'

Which process is being described?

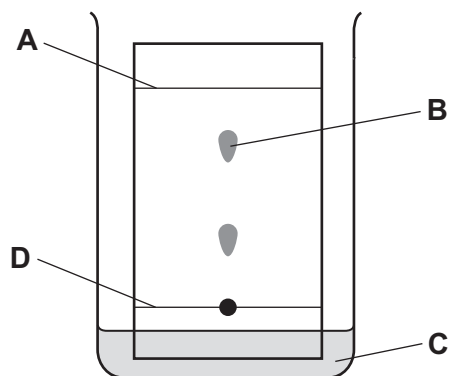
- A a liquid being frozen
  - B a solid melting
  - C a substance diffusing through a liquid
  - D a substance diffusing through the air
- 2 Oxygen melts at  $-219^{\circ}\text{C}$  and boils at  $-183^{\circ}\text{C}$ .

At which temperature is oxygen a liquid?

- A  $-225^{\circ}\text{C}$
  - B  $-189^{\circ}\text{C}$
  - C  $-175^{\circ}\text{C}$
  - D  $25^{\circ}\text{C}$
- 3 Which diagram shows a burette?



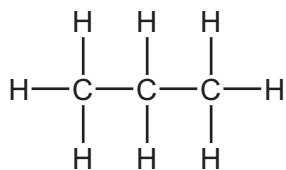
- 4 In the chromatography experiment shown, which label represents the solvent front?



- 5 Different methods of separation rely on substances having different properties.

Which property does distillation make use of?

- A boiling point
  - B colour
  - C particle size
  - D solubility in different solvents
- 6 Which statement about atomic structure is correct?
- A Isotopes have a different nucleon number but the same proton number.
  - B Metal atoms gain electrons to achieve a noble gas electronic structure.
  - C The nucleon number is the total number of electrons and neutrons in the nucleus of the atom.
  - D Protons and neutrons are oppositely charged particles.
- 7 Which element is a non-metal?
- A scandium
  - B sodium
  - C strontium
  - D sulfur
- 8 The structure of propane,  $C_3H_8$ , is shown.



How many electrons are involved in the bonding of propane?

- A 8                      B 10                      C 16                      D 20

- 9 Rubidium is in Group I of the Periodic Table and bromine is in Group VII.

Rubidium reacts with bromine to form an ionic compound.

Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?

|          | electron change | formula of ion formed |
|----------|-----------------|-----------------------|
| <b>A</b> | electron gained | $\text{Rb}^+$         |
| <b>B</b> | electron gained | $\text{Rb}^-$         |
| <b>C</b> | electron lost   | $\text{Rb}^+$         |
| <b>D</b> | electron lost   | $\text{Rb}^-$         |

- 10 Which statement explains why graphite is used as a lubricant?

- A** All bonds between the atoms are weak.
- B** It conducts electricity.
- C** It has a low melting point.
- D** Layers in the structure can slide over each other.

- 11 The formula of which compound contains the largest number of Group VII atoms?

- A**  $\text{C}_{13}\text{H}_{13}\text{IO}_8$       **B**  $\text{Cl}_2\text{O}_6$       **C**  $\text{Al}(\text{BrO}_3)_3$       **D**  $\text{NaFC}_2\text{H}_2\text{O}_2$

- 12 The relative atomic mass of chlorine is 35.5.

When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?

- A** a neutron
- B** a proton
- C** an atom of carbon-12
- D** an atom of hydrogen-1

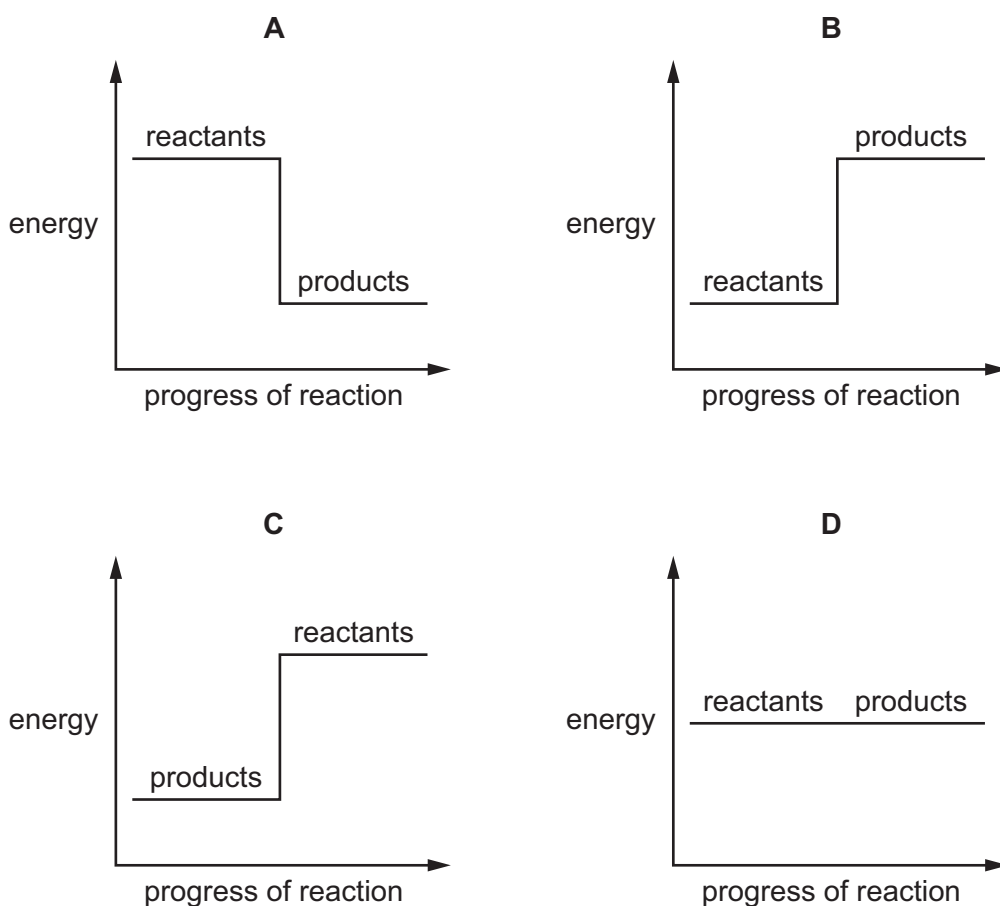
- 13 Universal indicator solution is added to a neutral solution of concentrated aqueous sodium chloride.

The solution, which contains  $\text{H}^+$  (hydrogen),  $\text{Na}^+$  (sodium),  $\text{Cl}^-$  (chloride) and  $\text{OH}^-$  (hydroxide) ions, is electrolysed.

The product at the cathode is hydrogen gas and the product at the anode is chlorine gas.

What happens to the colour of the indicator **in the solution** during electrolysis?

- A The colour changes from blue to green.
  - B The colour changes from blue to red.
  - C The colour changes from green to blue.
  - D The colour changes from green to red.
- 14 Which energy level diagram represents an endothermic reaction?



- 15 Which process is a physical change?

- A burning a piece of magnesium
- B dissolving calcium carbonate in hydrochloric acid
- C melting an ice cube
- D the rusting of an iron nail

16 Which substance does **not** require oxygen in order to produce energy?

- A coal
- B hydrogen
- C natural gas
- D  $^{235}\text{U}$

17 Nitrogen,  $\text{N}_2$ , and hydrogen,  $\text{H}_2$ , can be converted into ammonia,  $\text{NH}_3$ , using a catalyst.

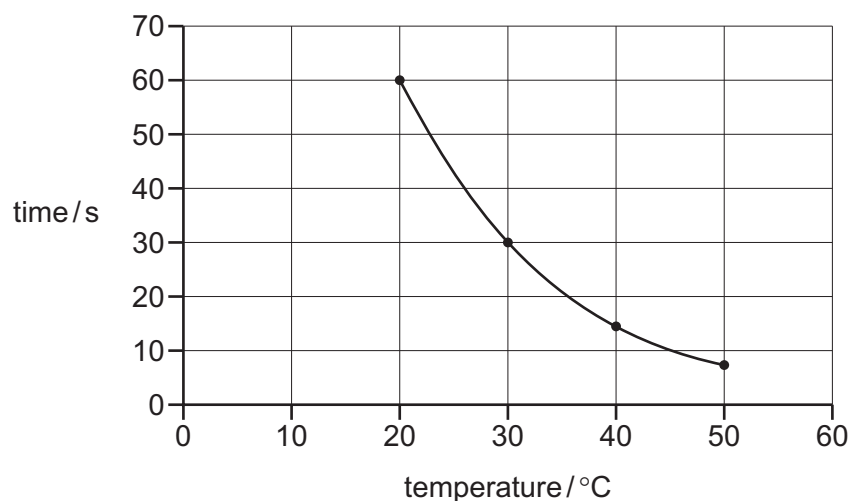
What is the purpose of the catalyst?

- A to increase the amount of ammonia produced
- B to increase the rate of reaction
- C to reduce the amount of reactants needed
- D to reduce the rate of reaction

18 A reaction is carried out at four different temperatures.

The time taken for the reaction to complete at each temperature is measured.

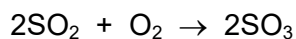
The results are shown.



What is the relationship between temperature and rate of reaction?

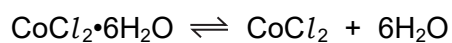
- A The rate decreases as the temperature increases.
- B The rate increases as the temperature increases.
- C The rate is proportional to the temperature.
- D The rate is inversely proportional to the temperature.

- 19 During the manufacture of sulfuric acid, sulfur dioxide is converted to sulfur trioxide.



Which type of reaction is this?

- A displacement
  - B neutralisation
  - C oxidation
  - D thermal decomposition
- 20 When pink crystals of cobalt(II) chloride are heated, steam is given off and the colour of the solid changes to blue.



What happens when water is added to the blue solid?

|   | colour          | temperature |
|---|-----------------|-------------|
| A | changes to pink | decreases   |
| B | changes to pink | increases   |
| C | remains blue    | decreases   |
| D | remains blue    | increases   |

- 21 Which statement describes a base?

- A It reacts with ammonium chloride to produce ammonia gas.
- B It reacts with calcium carbonate to produce carbon dioxide gas.
- C It reacts with copper to produce hydrogen gas.
- D It turns blue litmus red.

- 22 Which compound is an acidic oxide?

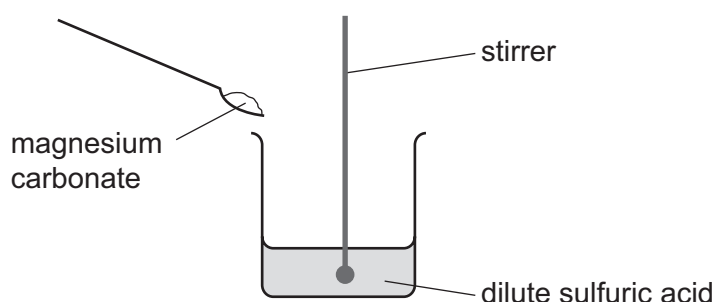
- A aluminium oxide
- B carbon dioxide
- C copper(II) oxide
- D magnesium oxide

23 Which statement describes how a flame test is done?

- A The tip of a clean wire is dipped into the substance and the wire is placed in a blue Bunsen burner flame.
- B The tip of a clean wire is dipped into the substance and the wire is placed in a yellow Bunsen burner flame.
- C A wooden splint is lit and is placed above a test-tube containing the gas being tested.
- D A wooden splint is lit, blown out and the glowing splint put into a test-tube of the gas being tested.

24 A student carries out an experiment to prepare pure magnesium sulfate crystals.

The diagram shows the first stage of the preparation.



He adds magnesium carbonate until no more reacts.

Which process should he use for the next stage?

- A crystallisation
- B evaporation
- C filtration
- D neutralisation

25 Which row about elements in the Periodic Table is correct?

|   | statement 1                                                      | statement 2                          |
|---|------------------------------------------------------------------|--------------------------------------|
| A | two elements in the same group have similar chemical properties  | metals are on the left of the table  |
| B | two elements in the same group have similar chemical properties  | metals are on the right of the table |
| C | two elements in the same period have similar chemical properties | metals are on the left of the table  |
| D | two elements in the same period have similar chemical properties | metals are on the right of the table |

**26** Tennessine, Ts, is a newly discovered element.

The atomic number of tennessine is 117 and it is placed directly underneath astatine in Group VII of the Periodic Table.

The trends in properties of Group VII elements are shown.

| element  | boiling point<br>/°C | colour      | density<br>in g/cm <sup>3</sup> | reactivity     |
|----------|----------------------|-------------|---------------------------------|----------------|
| fluorine | −188                 | pale yellow | 0.002                           | extremely high |
| chlorine | −35                  | green       | 0.003                           | very high      |
| bromine  | 60                   | red-brown   | 3.103                           | high           |
| iodine   | 184                  | dark grey   | 4.933                           | low            |

Which statement about the properties of tennessine is likely to be correct?

- A** Tennessine has a higher reactivity than astatine.
- B** Tennessine has a lower boiling point than astatine.
- C** Tennessine is a lighter colour than astatine.
- D** Tennessine is more dense than astatine.

**27** A flammable gas needs to be removed from a tank at an industrial plant.

For safety reasons, an inert gas is used.

Which gas is suitable?

- A** argon
- B** hydrogen
- C** methane
- D** oxygen

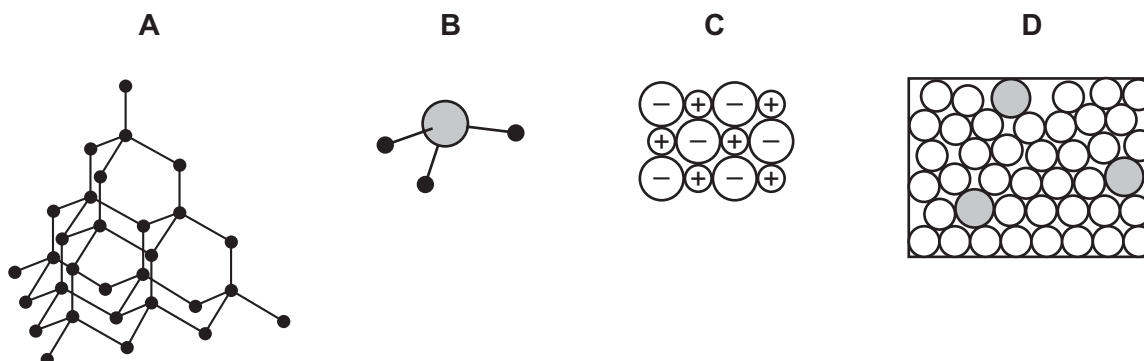
28 A substance, X, has the following properties.

- 1 It has a high melting point.
- 2 It conducts electricity in the solid and liquid states.
- 3 It is malleable.
- 4 It has a high density.

What is X?

- A a ceramic
- B copper
- C graphite
- D sodium chloride

29 Which diagram best represents the structure of a substance that is a good conductor of electricity at 25 °C?



30 Some properties of element Y are listed.

- It reacts with hydrochloric acid to make hydrogen gas.
- It reacts with steam but not with cold water.
- The oxide of Y cannot be reduced by carbon.

What is element Y?

- A copper
- B iron
- C magnesium
- D sodium

**31** Oxides of nitrogen are given out from car exhausts.

Which row best shows why oxides of nitrogen are unwanted in the atmosphere?

|          | acidic | toxic |
|----------|--------|-------|
| <b>A</b> | no     | no    |
| <b>B</b> | no     | yes   |
| <b>C</b> | yes    | no    |
| <b>D</b> | yes    | yes   |

**32** Water is purified using several processes.

Four of the processes are listed.

- 1 Chlorine is added to water to kill any bacteria.
- 2 Water is passed through coarse gravel to remove large pieces of dirt.
- 3 Water is passed through wire screens to remove large twigs.
- 4 Water is passed through fine sand to remove small particles.

In which order are the processes carried out?

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

**33** When solid S is heated strongly, it forms gas G.

G turns limewater cloudy.

What are S and G and which type of reaction does S undergo?

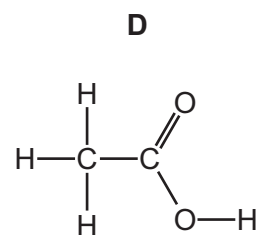
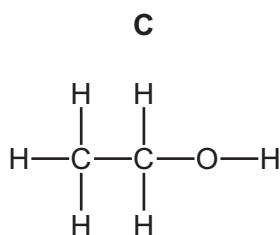
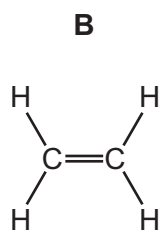
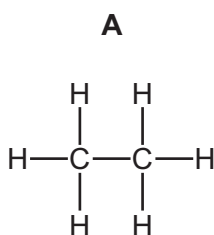
|          | S                 | G              | type of reaction      |
|----------|-------------------|----------------|-----------------------|
| <b>A</b> | calcium carbonate | carbon dioxide | combustion            |
| <b>B</b> | calcium carbonate | carbon dioxide | thermal decomposition |
| <b>C</b> | sodium carbonate  | oxygen         | combustion            |
| <b>D</b> | sodium carbonate  | oxygen         | thermal decomposition |

**34** The element sulfur is found in a number of different minerals.

Which mineral contains the greatest percentage by mass of sulfur?

- A** barite,  $\text{BaSO}_4$
- B** galena,  $\text{PbS}$
- C** gypsum,  $\text{CaSO}_4$
- D** pyrite,  $\text{FeS}_2$

**35** Which structure represents a molecule of ethanol?



**36** Petroleum is separated into fractions by fractional distillation.

Separation occurs in a fractionating column.

Some properties of three of these fractions are shown.

| fraction | boiling point range / °C | number of carbon atoms in the molecules |
|----------|--------------------------|-----------------------------------------|
| 1        |                          | 5–10                                    |
| 2        | 320–350                  | 16–24                                   |
| 3        | 120–210                  |                                         |

Which statement is correct?

- A** Fraction 1 has a higher boiling point range than fraction 2.
- B** Fraction 2 is removed from a higher point in the fractionating column than fraction 1.
- C** Molecules in fraction 3 have shorter chains than those in fraction 2.
- D** None of the fractions are liquid at room temperature.

37 Which statement describes methane?

- A It is an alcohol.
- B It is an unsaturated molecule.
- C It contains carbon, hydrogen and oxygen atoms only.
- D Each molecule contains four single covalent bonds.

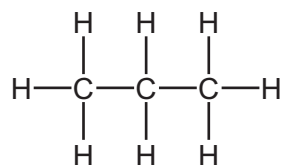
38 The flow chart shows the preparation of ethanol and some important chemistry of ethanol.



What are X, Y and Z?

|   | X       | Y              | Z       |
|---|---------|----------------|---------|
| A | yeast   | combustion     | oxygen  |
| B | glucose | combustion     | steam   |
| C | glucose | polymerisation | water   |
| D | yeast   | fermentation   | glucose |

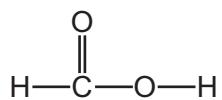
39 The structure of propane is shown.



Which statement about the atoms and the bonding in propane is correct?

- A All the bonds are single bonds.
- B Each carbon atom only bonds with two hydrogen atoms.
- C Propane is an unsaturated molecule.
- D There are three carbon-carbon bonds.

40 The structure of a compound X is shown.



X is in the same homologous series as ethanoic acid.

Which row describes some of the properties of an aqueous solution of X?

|          | reacts with $\text{CaCO}_3$<br>to produce a gas | neutralises<br>$\text{CuO}$ | turns methyl<br>orange red |
|----------|-------------------------------------------------|-----------------------------|----------------------------|
| <b>A</b> | no                                              | no                          | no                         |
| <b>B</b> | no                                              | yes                         | no                         |
| <b>C</b> | yes                                             | yes                         | yes                        |
| <b>D</b> | yes                                             | no                          | yes                        |

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The Periodic Table of Elements

| Group                    |                             |                                                                                             |  |  |  |  |  |  |  |  |  |                         |                       |                        |                          |                        |                          |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 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 | 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 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 11<br>Na<br>sodium<br>23 | 12<br>Mg<br>magnesium<br>24 |                                                                                             |  |  |  |  |  |  |  |  |  |                         |                       |                        |                          |                        |                          |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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



# Cambridge IGCSE™

## CHEMISTRY

0620/13

Paper 1 Multiple Choice (Core)

October/November 2020

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. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Blank pages are indicated.



- 1 'The movement of a substance **very slowly** from an area of high concentration to an area of low concentration.'

Which process is being described?

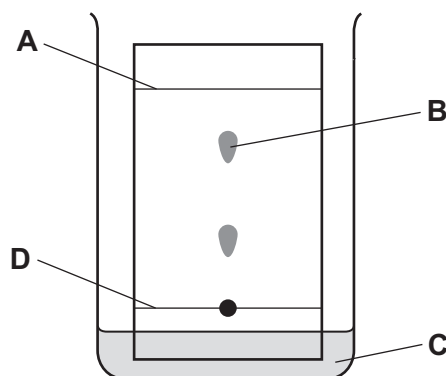
- A a liquid being frozen
  - B a solid melting
  - C a substance diffusing through a liquid
  - D a substance diffusing through the air
- 2 When a dark grey solid element is heated, it changes directly into a purple gas.

Which word describes this change?

- A boiling
  - B evaporation
  - C melting
  - D sublimation
- 3 Nickel(II) sulfate is a green solid that is soluble in water.

Which method is used to obtain a pure sample of nickel(II) sulfate crystals from a mixture of nickel(II) sulfate and sand?

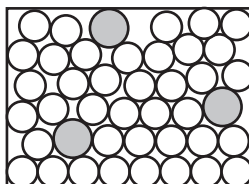
- A Heat the mixture with water and distil it to give nickel(II) sulfate.
  - B Heat the mixture with water and leave it to crystallise.
  - C Heat the mixture with water and filter off the nickel(II) sulfate.
  - D Heat the mixture with water, filter and allow the solution to crystallise.
- 4 In the chromatography experiment shown, which label represents the solvent front?



5 What is the meaning of the term *nucleon number*?

- A the number of neutrons in the nucleus of an atom
- B the number of protons in the nucleus of an atom
- C the total number of protons and electrons in the nucleus of an atom
- D the total number of protons and neutrons in the nucleus of an atom

6 The diagram represents the structure of a solid.



What could the solid be?

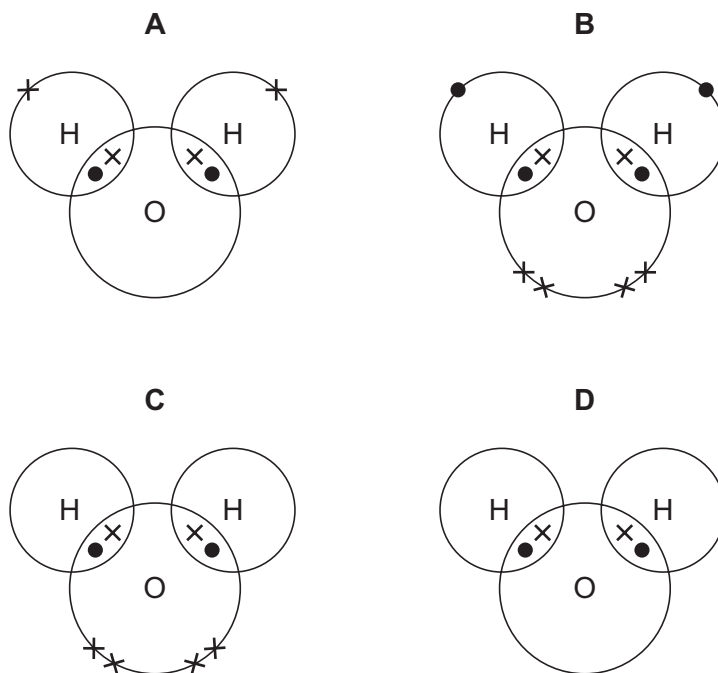
|   | brass | graphite | sodium chloride |
|---|-------|----------|-----------------|
| A | ✓     | ✓        | x               |
| B | ✓     | x        | x               |
| C | x     | ✓        | ✓               |
| D | x     | x        | ✓               |

7 Magnesium reacts with sulfuric acid.

What are the formulae of the products formed in this reaction?

- A  $\text{MgSO}_4$  and  $\text{H}_2$
- B  $\text{MgSO}_4$  and  $\text{H}_2\text{O}$
- C  $\text{Mg}(\text{SO}_4)_2$  and  $\text{H}_2$
- D  $\text{Mg}(\text{SO}_4)_2$  and  $\text{H}_2\text{O}$

- 8 Which diagram shows the arrangement of the outer shell electrons in a molecule of water?



- 9 Rubidium is in Group I of the Periodic Table and bromine is in Group VII.

Rubidium reacts with bromine to form an ionic compound.

Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?

|          | electron change | formula of ion formed |
|----------|-----------------|-----------------------|
| <b>A</b> | electron gained | $\text{Rb}^+$         |
| <b>B</b> | electron gained | $\text{Rb}^-$         |
| <b>C</b> | electron lost   | $\text{Rb}^+$         |
| <b>D</b> | electron lost   | $\text{Rb}^-$         |

- 10 Which statement explains why graphite is used as a lubricant?

- A** All bonds between the atoms are weak.
- B** It conducts electricity.
- C** It has a low melting point.
- D** Layers in the structure can slide over each other.

- 11 The relative atomic mass of chlorine is 35.5.

When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?

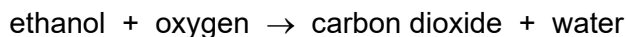
- A a neutron
- B a proton
- C an atom of carbon-12
- D an atom of hydrogen-1

- 12 Molten sodium chloride is electrolysed using inert electrodes.

Which row shows the products formed at the cathode and anode?

|   | cathode  | anode    |
|---|----------|----------|
| A | chlorine | hydrogen |
| B | chlorine | sodium   |
| C | hydrogen | chlorine |
| D | sodium   | chlorine |

- 13 Ethanol is used as a fuel.



Which statements are correct?

- 1 The reaction is endothermic.
- 2 The products have more energy than the reactants.
- 3 The oxygen for this reaction comes from the air.
- 4 The temperature of the reaction mixture rises during this reaction.

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

- 14 Hydrogen and the isotope uranium-235 are both used to generate electricity.

Which term describes the change that occurs for **both** substances in this context?

- A combustion
- B endothermic
- C exothermic
- D decomposition

15 Which substance does **not** require oxygen in order to produce energy?

- A coal
- B hydrogen
- C natural gas
- D  $^{235}\text{U}$

16 When calcium carbonate reacts with dilute hydrochloric acid, carbon dioxide gas is given off.

This causes the reaction mixture to lose mass.

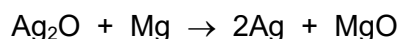
Four separate experiments are performed.

The starting mass, and the mass after five minutes, are measured for each reaction mixture.

In which experiment is carbon dioxide produced at the greatest rate?

|   | starting mass/g | mass after five minutes/g |
|---|-----------------|---------------------------|
| A | 14.37           | 11.89                     |
| B | 16.52           | 15.29                     |
| C | 16.76           | 14.12                     |
| D | 16.99           | 15.21                     |

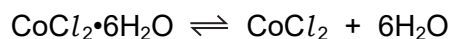
17 Silver oxide reacts with magnesium to make silver and magnesium oxide.



Which substance is oxidised in this reaction?

- A magnesium
- B magnesium oxide
- C silver
- D silver oxide

- 18 When pink crystals of cobalt(II) chloride are heated, steam is given off and the colour of the solid changes to blue.



What happens when water is added to the blue solid?

|          | colour          | temperature |
|----------|-----------------|-------------|
| <b>A</b> | changes to pink | decreases   |
| <b>B</b> | changes to pink | increases   |
| <b>C</b> | remains blue    | decreases   |
| <b>D</b> | remains blue    | increases   |

- 19 Which oxide is used to neutralise acidic gases in a power station?

- A** calcium oxide
- B** carbon dioxide
- C** nitrogen oxide
- D** sulfur dioxide

- 20 Period 3 of the Periodic Table contains the elements sodium to argon.

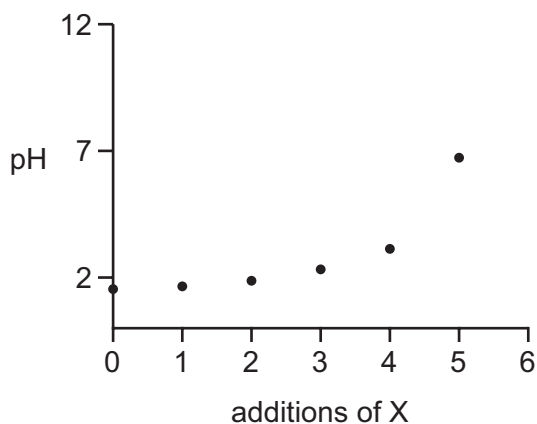
Element Q is a non-metal from this period.

Which statement about Q is correct?

- A** It conducts electricity.
- B** It has a lower proton number than sodium.
- C** It has electrons in only three shells.
- D** It is malleable.

- 21** Equal masses of a solid, X, are added in turn to an aqueous solution, Y.

The pH of the solution is measured after each addition until the pH becomes 7. The readings are plotted as shown.



What are X and Y?

|          | X                       | Y        |
|----------|-------------------------|----------|
| <b>A</b> | Cu(s)                   | HCl(aq)  |
| <b>B</b> | Mg(s)                   | HCl(aq)  |
| <b>C</b> | NH <sub>4</sub> Cl(s)   | NaOH(aq) |
| <b>D</b> | Zn(OH) <sub>2</sub> (s) | NaOH(aq) |

- 22** An aqueous cation reacts with aqueous sodium hydroxide to form a white precipitate.

The precipitate is insoluble in excess sodium hydroxide.

What is the aqueous cation?

- A** aluminium ion
- B** calcium ion
- C** chromium ion
- D** zinc ion

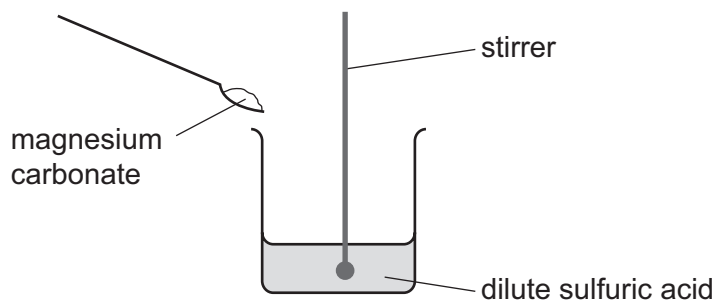
- 23** Vinegar has a pH of 3.

Which statement about vinegar is correct?

- A** It forms a salt with sulfuric acid.
- B** It reacts with some metals to form hydrogen gas.
- C** It reacts with ammonium compounds to give ammonia gas.
- D** It turns red litmus blue.

- 24** A student carries out an experiment to prepare pure magnesium sulfate crystals.

The diagram shows the first stage of the preparation.



He adds magnesium carbonate until no more reacts.

Which process should he use for the next stage?

- A** crystallisation
  - B** evaporation
  - C** filtration
  - D** neutralisation
- 25** Which statement about the halogens and their compounds is correct?
- A** The colour of the element gets lighter going down Group VII.
  - B** The elements get less dense going down Group VII.
  - C** When chlorine is added to sodium iodide solution, iodine is formed.
  - D** When iodine is added to sodium bromide solution, bromine is formed.
- 26** Which compound contains a transition metal ion and a halide ion?
- A** aluminium iodide
  - B** calcium fluoride
  - C** iron(III) oxide
  - D** nickel(II) chloride

- 27** A flammable gas needs to be removed from a tank at an industrial plant.

For safety reasons, an inert gas is used.

Which gas is suitable?

- A** argon
- B** hydrogen
- C** methane
- D** oxygen

- 28** A substance, X, has the following properties.

- 1 It has a high melting point.
- 2 It conducts electricity in the solid and liquid states.
- 3 It is malleable.
- 4 It has a high density.

What is X?

- A** a ceramic
- B** copper
- C** graphite
- D** sodium chloride

- 29** A metal M is between sodium and magnesium in the reactivity series.

Which reactions occur with M and its oxide?

|          | M reacts<br>with steam | M can be extracted<br>by heating its oxide<br>with carbon |
|----------|------------------------|-----------------------------------------------------------|
| <b>A</b> | no                     | no                                                        |
| <b>B</b> | no                     | yes                                                       |
| <b>C</b> | yes                    | no                                                        |
| <b>D</b> | yes                    | yes                                                       |

**30** Mild steel and stainless steel are two alloys containing the element iron.

Which row identifies a use of each alloy?

|          | a use of mild steel | a use of stainless steel |
|----------|---------------------|--------------------------|
| <b>A</b> | car bodies          | cutlery                  |
| <b>B</b> | car bodies          | electrical wiring        |
| <b>C</b> | food containers     | cutlery                  |
| <b>D</b> | food containers     | electrical wiring        |

**31** Coke (carbon) and limestone are two raw materials used in the extraction of iron from hematite.

Which type of reaction occurs when each substance is heated during the process?

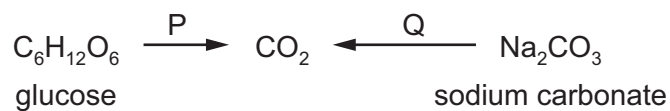
|          | coke                  | limestone             |
|----------|-----------------------|-----------------------|
| <b>A</b> | redox                 | redox                 |
| <b>B</b> | redox                 | thermal decomposition |
| <b>C</b> | thermal decomposition | redox                 |
| <b>D</b> | thermal decomposition | thermal decomposition |

**32** Oxides of nitrogen are given out from car exhausts.

Which row best shows why oxides of nitrogen are unwanted in the atmosphere?

|          | acidic | toxic |
|----------|--------|-------|
| <b>A</b> | no     | no    |
| <b>B</b> | no     | yes   |
| <b>C</b> | yes    | no    |
| <b>D</b> | yes    | yes   |

33 Two reactions, P and Q, produce carbon dioxide.



Which types of reaction are P and Q?

|          | P              | Q              |
|----------|----------------|----------------|
| <b>A</b> | neutralisation | neutralisation |
| <b>B</b> | neutralisation | respiration    |
| <b>C</b> | respiration    | neutralisation |
| <b>D</b> | respiration    | respiration    |

34 Which gas is used as a food preservative?

- A** methane
- B** fluorine
- C** oxygen
- D** sulfur dioxide

35 Which calcium compound does **not** neutralise an acid soil?

- A** calcium oxide
- B** calcium sulfate
- C** calcium hydroxide
- D** calcium carbonate

36 Petroleum is separated into fractions by fractional distillation.

Separation occurs in a fractionating column.

Some properties of three of these fractions are shown.

| fraction | boiling point range / °C | number of carbon atoms in the molecules |
|----------|--------------------------|-----------------------------------------|
| 1        |                          | 5–10                                    |
| 2        | 320–350                  | 16–24                                   |
| 3        | 120–210                  |                                         |

Which statement is correct?

- A Fraction 1 has a higher boiling point range than fraction 2.
- B Fraction 2 is removed from a higher point in the fractionating column than fraction 1.
- C Molecules in fraction 3 have shorter chains than those in fraction 2.
- D None of the fractions are liquid at room temperature.

37 How many atoms are there in one molecule of ethanoic acid?

- A 5                      B 6                      C 8                      D 11

38 The flow chart shows the preparation of ethanol and some important chemistry of ethanol.



What are X, Y and Z?

|   | X       | Y              | Z       |
|---|---------|----------------|---------|
| A | yeast   | combustion     | oxygen  |
| B | glucose | combustion     | steam   |
| C | glucose | polymerisation | water   |
| D | yeast   | fermentation   | glucose |

39 Which substance is **not** a fraction obtained from the fractional distillation of petroleum?

- A ethene
- B fuel oil
- C naphtha
- D refinery gas

**40** Some plastics are non-biodegradable.

What is the meaning of the term *non-biodegradable*?

- A** cannot be recycled for further use
- B** gives off greenhouse gases when burnt
- C** harmful to animals and plants
- D** not broken down by natural processes

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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       | 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>— |                             | 114<br>Fl<br>flerovium<br>— |                              | 116<br>Lv<br>livermorium<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.).