Cambridge Assessment International Education

# Cambridge IGCSE™

**CHEMISTRY** **0620/12**

Paper 1 Multiple Choice (Core) **February/March 2024**

**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)

*6983588736*

**INSTRUCTIONS**

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

**INFORMATION**

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

This document has **16** pages. Any blank pages are indicated.




**[Turn over**

**1** Which statement about a solid, a liquid or a gas is correct?

**A** A solid has a fixed shape and can be compressed.

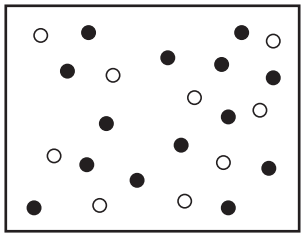
**B** A liquid takes the shape of the container it is in and can be compressed.

**C** A solid has no fixed shape and cannot be compressed.

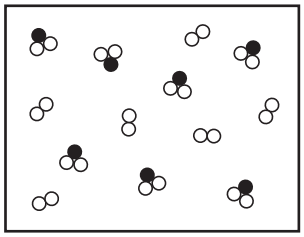
**D** A gas takes the shape of the container it is in and can be compressed.

**2** Which diagram represents a mixture of compounds?

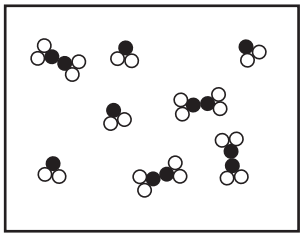
**A**



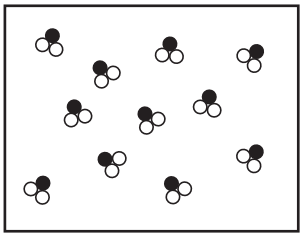
**B**



**C**



**D**



**3** Four ions are listed.

$N^{3-}$ $Al^{3+}$ $Li^{+}$ $Cl^{-}$

Which pair of ions have the same electronic configuration?

**A** $N^{3-}$ and $Li^{+}$

**B** $Al^{3+}$ and $N^{3-}$

**C** $Cl^{-}$ and $Al^{3+}$

**D** $Li^{+}$ and $Cl^{-}$

**4** Which statement about isotopes is correct?

**A** Atoms with different numbers of electrons are isotopes of each other.

**B** Atoms with the same mass numbers are isotopes of each other.

**C** Isotopes of the same element have different numbers of neutrons.

**D** Isotopes of the same element have different numbers of protons.

**5** Which statement about the ions formed by the elements in Group VII of the Periodic Table is correct?

**A** All the ions have the same charge of 1–.

**B** All the ions have the same number of electron shells.

**C** Each ion is formed by losing one electron.

**D** Each ion has seven electrons in its outer electron shell.

**6** Which row describes the properties of potassium bromide?

| | soluble in water | melting point | electrical conductivity when solid |
|---|---|---|---|
| **A** | no | high | good |
| **B** | yes | low | good |
| **C** | no | low | poor |
| **D** | yes | high | poor |

**7** Which statement explains why graphite is used as a lubricant?

**A** Each carbon atom in graphite forms three bonds.

**B** The bonding in graphite is covalent.

**C** The carbon atoms are arranged in hexagons.

**D** There are weak forces of attraction between the layers of carbon atoms.

**8** What is the balanced equation for the reaction between magnesium and dilute sulfuric acid?

**A** $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

**B** $Mg + 2H_2SO_4 \rightarrow Mg(SO_4)_2 + 2H_2$

**C** $2Mg + H_2SO_4 \rightarrow Mg_2SO_4 + H_2$

**D** $2Mg + 3H_2SO_4 \rightarrow Mg_2(SO_4)_3 + 3H_2$

**9** The relative atomic mass, $A_r$, of an element is the average mass of the isotopes of that element compared to another particle.

Which particle is used for this comparison?

**A** a proton

**B** an atom of $^{12}C$

**C** an atom of $^{40}Ca$

**D** an atom of $^{1}H$

**10** The equations for two reactions are shown.

equation 1 $C + CO_2 \rightarrow x\ CO$

equation 2 $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + y\ H_2O$

Which row shows the value of *x*, the value of *y* and the equations that are for redox reactions?

| | value of *x* | value of *y* | redox reactions |
|---|---|---|---|
| **A** | 1 | 3 | equation 1 only |
| **B** | 2 | 3 | equations 1 and 2 |
| **C** | 2 | 6 | equation 1 only |
| **D** | 2 | 6 | equations 1 and 2 |

**11** Concentrated aqueous sodium chloride is electrolysed using graphite electrodes.

What is the product formed at the cathode?

**A** chlorine

**B** hydrogen

**C** oxygen

**D** sodium

**12** Which row describes the changes that occur when metals burn in oxygen?

| | temperature | metal |
|---|---|---|
| **A** | decreases | oxidised |
| **B** | decreases | reduced |
| **C** | increases | oxidised |
| **D** | increases | reduced |

**13** When calcium carbonate is heated strongly, carbon dioxide gas is produced.

Which words describe the type of change that occurs?

**A** endothermic and chemical

**B** endothermic and physical

**C** exothermic and chemical

**D** exothermic and physical

**14** Which row about a hydrogen–oxygen fuel cell is correct?

| | energy transfer | equation for the reaction |
|---|---|---|
| **A** | chemical to electrical | $2H_2 + O_2 \rightarrow 2H_2O$ |
| **B** | chemical to electrical | $2H_2O \rightarrow 2H_2 + O_2$ |
| **C** | electrical to chemical | $2H_2 + O_2 \rightarrow 2H_2O$ |
| **D** | electrical to chemical | $2H_2O \rightarrow 2H_2 + O_2$ |

**15** Which list contains **only** chemical changes?

**A** melting, evaporating, dissolving

**B** rusting, freezing, cracking

**C** neutralisation, polymerisation, combustion

**D** boiling, condensing, distillation

**16** Excess calcium carbonate is added to 50 $cm^3$ of dilute hydrochloric acid of different concentrations in two separate experiments.

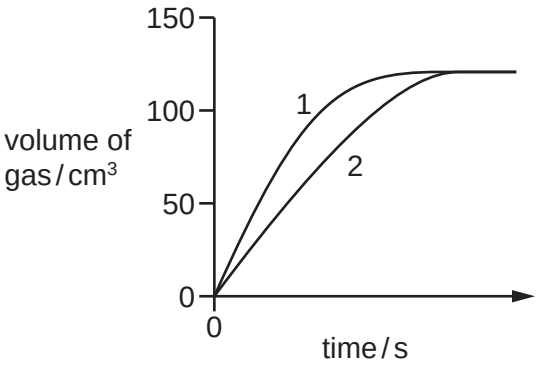
The volume of gas produced in experiment 1 and in experiment 2 is measured every 30 seconds.

The results are shown.

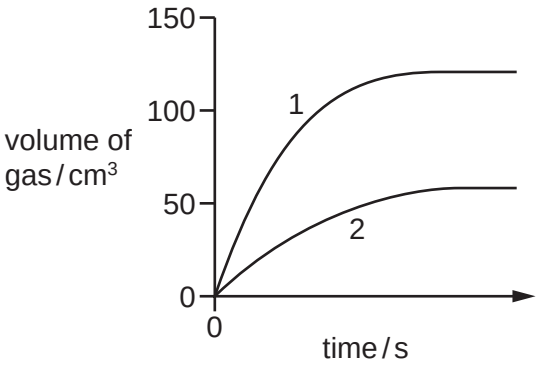
| experiment | concentration of hydrochloric acid in $mol/dm^3$ | volume of gas after 30 seconds in $cm^3$ | volume of gas after 60 seconds in $cm^3$ | final volume of gas in $cm^3$ |
|---|---|---|---|---|
| 1 | 0.20 | 55 | 99 | 120 |
| 2 | 0.10 | 26 | 50 | 59 |

Which diagram represents the data collected?

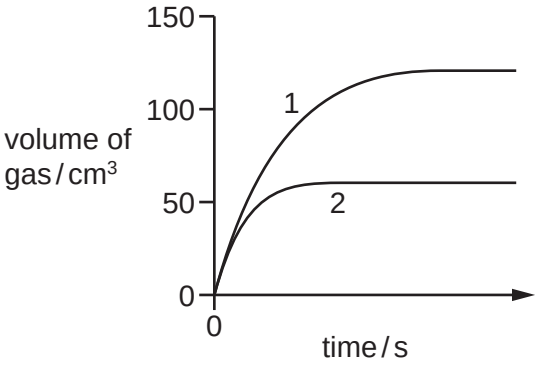
**A**



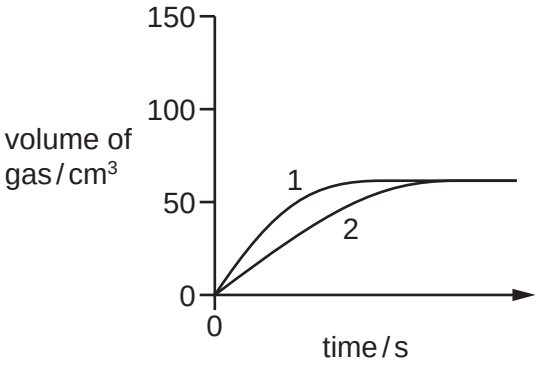

**B**




**C**

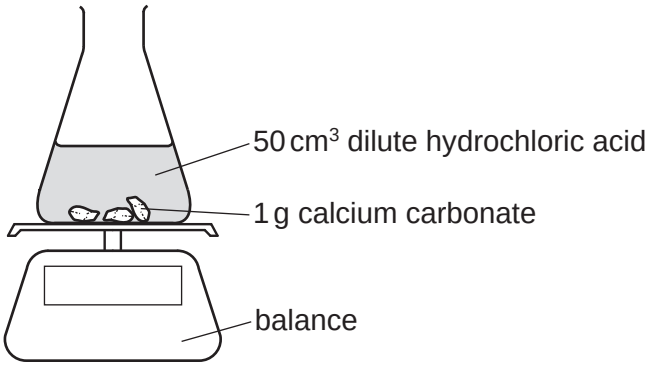



**D**



**17** An experiment is set up as shown.

The mass of the conical flask and its contents is measured at 30-second intervals.




Which statement about the reaction and changes to the reaction conditions is correct?

**A** Adding 10 $cm^3$ of water to the 50 $cm^3$ of acid increases the rate of the reaction.

**B** Increasing the size of the pieces of calcium carbonate increases the rate of the reaction.

**C** Increasing the temperature increases the rate of the reaction.

**D** The mass of the conical flask and its contents increases as carbon dioxide is formed.

**18** Which reaction is reversible?

**A** reaction of aqueous sodium hydroxide with dilute hydrochloric acid

**B** formation of anhydrous copper(II) sulfate from hydrated copper(II) sulfate

**C** oxidation of methane to form carbon dioxide and water

**D** combustion of sulfur to form sulfur dioxide

**19** Silver oxide reacts with magnesium to make silver and magnesium oxide.

$$Ag_2O + Mg \rightarrow 2Ag + MgO$$

Which substance is oxidised in this reaction?

**A** magnesium

**B** magnesium oxide

**C** silver

**D** silver oxide

**20** Compound X dissolves in water to form an aqueous solution.

Methyl orange is added to aqueous compound X.

The methyl orange turns red.

What is compound X?

**A** sodium carbonate

**B** copper(II) oxide

**C** potassium oxide

**D** sulfur dioxide

**21** Dilute hydrochloric acid reacts with aqueous sodium hydroxide in a neutralisation reaction.

Which two ions are involved in this neutralisation reaction?

**A** $Na^+$ and $H^+$ **B** $H^+$ and $OH^-$ **C** $Na^+$ and $Cl^-$ **D** $OH^-$ and $Cl^-$

**22** The table shows some properties of some of the elements in Group I of the Periodic Table.

| element | melting point / °C | reaction with water |
|---|---|---|
| lithium | 181 | fizzes steadily |
| sodium | 98 | fizzes vigorously |
| potassium | 64 | fizzes very vigorously |

Rubidium is also an element in Group I of the Periodic Table.

Which row describes the properties of rubidium?

| | melting point / °C | reaction with water |
|---|---|---|
| **A** | 39 | fizzes slowly |
| **B** | 39 | fizzes explosively |
| **C** | 81 | fizzes very vigorously |
| **D** | 81 | fizzes explosively |

**23** Copper(II) sulfate crystals are blue. They are made by adding an excess of copper(II) oxide to sulfuric acid.

The mixture is heated and stirred.

The mixture is then filtered and the filtrate is allowed to evaporate, leaving blue crystals.

Why is filtration necessary?

**A** to remove soluble impurities

**B** to remove sulfuric acid

**C** to remove the blue crystals

**D** to remove unreacted copper(II) oxide

**24** Which barium salts are soluble in water?

1 barium carbonate

2 barium chloride

3 barium nitrate

4 barium sulfate

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

**25** Which statement about the properties of elements in Group I or in Group VII is correct?

**A** Bromine displaces iodine from an aqueous solution of potassium iodide.

**B** Chlorine, bromine and iodine are diatomic gases at room temperature.

**C** Lithium, sodium and potassium are soft non-metals.

**D** Lithium, sodium and potassium have an increasing number of electrons in their outer shells.

**26** Rubidium and strontium are both in Period 5 of the Periodic Table.

Rubidium is in Group I. Strontium is in Group II.

Which statement about these elements is correct?

**A** Each element has five electrons in its outer electron shell.

**B** The atomic number of rubidium is greater than the atomic number of strontium.

**C** Rubidium forms the $Rb^+$ ion; strontium forms the $Sr^{2+}$ ion.

**D** Electrolysis of molten rubidium chloride and of molten strontium chloride produces hydrogen.

**27** A company needs a metal with a low density which resists corrosion and is a good electrical conductor.

Which metal should it use?

**A** aluminium

**B** iron

**C** magnesium

**D** sodium

**28** Which statement about stainless steel is correct?

**A** All atoms in stainless steel are the same size.

**B** Stainless steel is a mixture of copper and zinc.

**C** Stainless steel is an iron compound.

**D** Stainless steel is stronger than pure iron.

**29** Which statements explain why a water tap made of steel is electroplated with copper?

1 It improves the conductivity of the tap.

2 It improves the tap's resistance to corrosion.

3 It increases the density of the tap.

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

**30** The table shows the results of separately heating four metals with oxides of different metals.

The four metals are iron, copper, magnesium and Y.

The results are shown.

| metal | magnesium oxide | Y oxide | copper oxide | iron oxide |
|---|---|---|---|---|
| iron | ✗ | ✗ | ✓ | ✗ |
| copper | ✗ | ✗ | ✗ | ✗ |
| magnesium | ✗ | ✓ | ✓ | ✓ |
| Y | ✗ | ✗ | ✓ | ✓ |

key

✓ = reaction

✗ = no reaction

What is the order of reactivity of the metals, least reactive first?

| | least reactive → most reactive | | | |
|---|---|---|---|---|
| **A** | copper | iron | Y | magnesium |
| **B** | copper | Y | iron | magnesium |
| **C** | magnesium | iron | Y | copper |
| **D** | magnesium | Y | iron | copper |

**31** Which metal is most easily obtained from its ore?

**A** aluminium

**B** copper

**C** calcium

**D** iron

**32** Why is distilled water used in chemical experiments rather than tap water?

**A** Distilled water contains fewer chemical impurities.

**B** Distilled water has a better colour.

**C** Distilled water has a higher boiling point.

**D** Distilled water is a better solvent.

**33** Which type of compound is also the name of a homologous series?

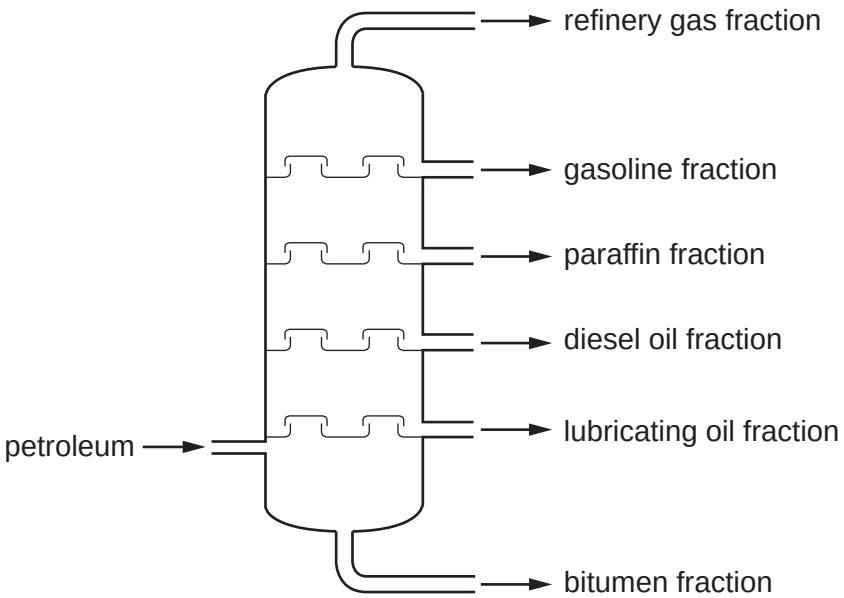
**A** carbonate

**B** carboxylic acid

**C** halide

**D** hydroxide

**34** The fractional distillation of petroleum is shown.




Which fraction is the least volatile?

**A** bitumen

**B** diesel oil

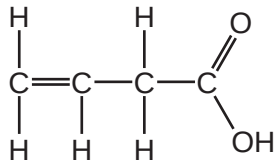
**C** gasoline

**D** refinery gas

**35** Which formula represents an unsaturated hydrocarbon?

**A** $C_3H_6$ **B** $C_3H_8$ **C** $C_4H_{10}$ **D** $C_5H_{12}$

**36** The structure of an organic compound is shown.



The compound is tested separately with thymolphthalein and with aqueous bromine.

Which row describes the final colour observed for each test?

| | thymolphthalein | aqueous bromine |
|---|---|---|
| **A** | blue | colourless |
| **B** | blue | orange |
| **C** | colourless | colourless |
| **D** | colourless | orange |

**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** Its molecules contain four single covalent bonds.

**38** Which row explains why plastics such as poly(ethene) cause pollution?

| | produce toxic gases when burned | accumulate in the oceans |
|---|---|---|
| **A** | no | no |
| **B** | no | yes |
| **C** | yes | no |
| **D** | yes | yes |

**39** Two experiments are described.

| | |
|---|---|
| experiment 1 | A large mass of copper(II) sulfate is stirred into a beaker of water. After a few minutes, undissolved crystals are visible on the bottom of the beaker. |
| experiment 2 | Sea water is distilled. Distilled water and solid impure salt are separated into two containers. |

Which statement is correct?

**A** In experiment 1, the undissolved crystals are the filtrate.

**B** In experiment 1, the water is the solute.

**C** In experiment 2, sea water boils at 100 °C.

**D** In experiment 2, the impure salt is a residue.

**40** An aqueous sample of X is heated with aqueous sodium hydroxide and small pieces of aluminium. A gas is produced which turns damp red litmus paper blue.

Aqueous sodium hydroxide is added to a second aqueous sample of X. A pale green precipitate is observed.

What is X?

**A** ammonium nitrate

**B** chromium(II) chloride

**C** iron(II) nitrate

**D** iron(II) sulfate

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## The Periodic Table of Elements

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

**Key**

atomic number
atomic symbol
name
relative atomic mass

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

The volume of one mole of any gas is 24 $dm^3$ at room temperature and pressure (r.t.p.).