



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY

0620/22

Paper 2 Multiple Choice (Extended)

February/March 2018

45 minutes

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



READ THESE INSTRUCTIONS FIRST

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

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 16.
Electronic calculators may be used.

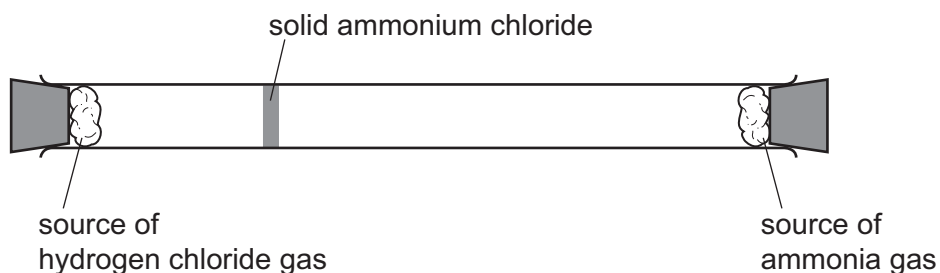
The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **15** printed pages and **1** blank page.

- 1 Hydrogen chloride gas, HCl , reacts with ammonia gas, NH_3 , to form solid ammonium chloride.

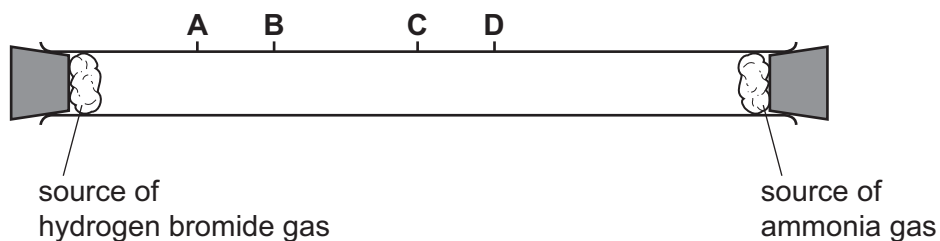
The apparatus is set up as shown.

After a few minutes, solid ammonium chloride forms where the two gases meet.



The experiment is repeated using hydrogen bromide, HBr , in place of hydrogen chloride.

How far along the tube does the solid ammonium bromide form?



- 2 Substance L melts at -7°C and is a brown liquid at room temperature.

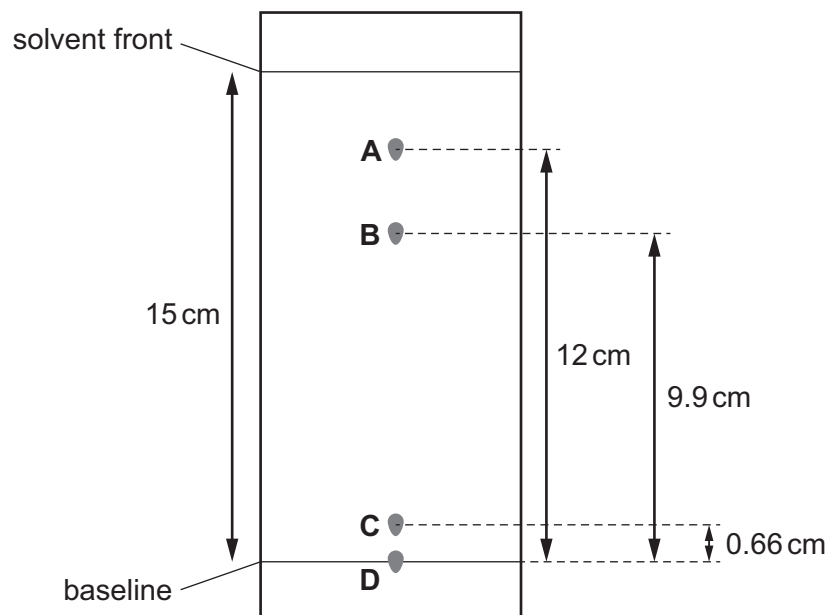
Which temperature is the boiling point of pure L?

- A -77°C
- B -7°C to $+7^\circ\text{C}$
- C 59°C
- D 107°C to 117°C

- 3 Chromatography is done on a mixture containing a drug. The drug has an R_f value of 0.66.

The diagram is **not** drawn to scale.

Which spot on the chromatogram represents the drug?



- 4 Caesium, Cs, is an element in Group I of the Periodic Table.

When caesium reacts it forms a positive ion, Cs^+ .

How is a caesium ion formed?

- A** A caesium atom gains a proton.
B A caesium atom gains an electron.
C A caesium atom loses an electron.
D A caesium atom shares an electron.
- 5 The structure of copper is described as a lattice of positive ions in a 'sea of electrons'.

Which statements are correct?

- 1 Copper has a high melting point because of the strong electrostatic attraction between the positive ions and the 'sea of electrons'.
- 2 Copper is malleable because the layers of atoms in the lattice can slide over each other.
- 3 Copper atoms can be oxidised to form copper ions by losing electrons.

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

- 6 Three statements about diamond, graphite and silicon(IV) oxide are listed.
- 1 Diamond and graphite both have giant covalent structures.
 - 2 In silicon(IV) oxide, silicon and oxygen atoms are joined together by covalent bonds throughout the whole structure.
 - 3 Diamond and silicon(IV) oxide have similar structures.

Which statements are correct?

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

- 7 The concentration of a hydrochloric acid solution is 0.5 mol/dm^3 .

How many moles of hydrochloric acid are present in 25 cm^3 of this solution?

- A** 0.0125 **B** 0.0200 **C** 12.5 **D** 20.0

- 8 A sample of an iron oxide contains 50.4 g of iron and 21.6 g of oxygen.

What is the empirical formula of the iron oxide?

- A** FeO **B** FeO₃ **C** Fe₂O₃ **D** Fe₃O₂

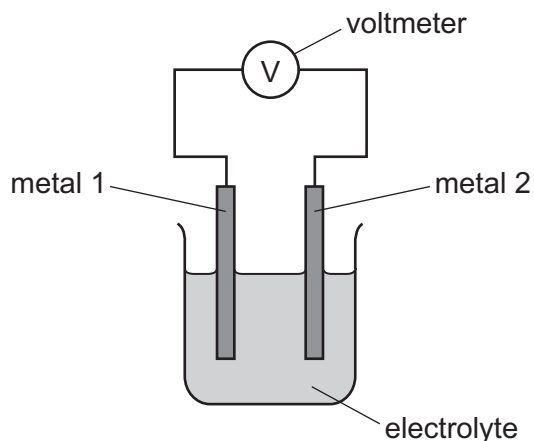
- 9 A solution of copper(II) sulfate can be electrolysed using copper electrodes or carbon electrodes.

Which statements are correct?

- 1 Using copper electrodes, oxygen gas forms at the anode.
- 2 Using copper electrodes, copper atoms lose electrons at the anode.
- 3 Using carbon electrodes, copper metal forms at the cathode.
- 4 Using carbon electrodes, copper ions gain electrons at the cathode.

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

10 Pairs of metals are connected together to make a simple cell, as shown.



The table shows the reading on the voltmeter when different metals are used.

| | | metal 2 | | | |
|---------|-----------|-----------|---------|---------|-----------|
| | | beryllium | cerium | cobalt | manganese |
| metal 1 | beryllium | 0.00 V | +0.64 V | -1.57 V | -0.67 V |
| | cerium | | 0.00 V | -2.21 V | -1.30 V |
| | cobalt | | | 0.00 V | +0.90 V |
| | manganese | | | | 0.00 V |

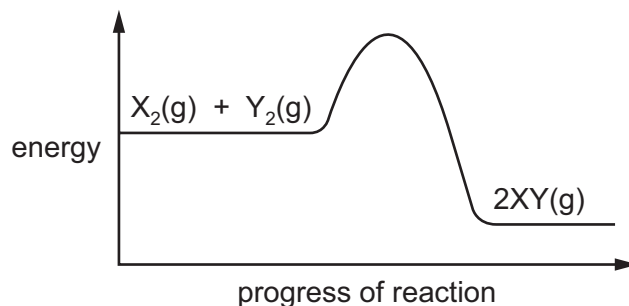
If metal 2 is more reactive than metal 1, the voltage measured is positive.

The greater the difference in reactivity of the metals, the larger the reading on the voltmeter.

What is the order of reactivity?

| | most reactive → least reactive | | | |
|----------|---|-----------|-----------|-----------|
| A | cerium | beryllium | cobalt | manganese |
| B | cerium | beryllium | manganese | cobalt |
| C | cobalt | manganese | beryllium | cerium |
| D | cobalt | manganese | cerium | beryllium |

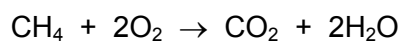
11 The energy level diagram for the reaction between X_2 and Y_2 to form XY gas is shown.



Which statement is correct?

- A Energy is released when X_2 and Y_2 bonds are broken.
- B Energy is needed to form XY bonds.
- C The energy change, ΔH , for the reaction is negative.
- D The reaction is endothermic.

12 Methane burns in oxygen to form carbon dioxide and water.



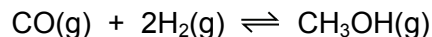
The bond energies are shown in the table.

| bond | bond energy in kJ/mol |
|------|--------------------------|
| C–H | +410 |
| C=O | +805 |
| O–H | +460 |
| O=O | +496 |

What is the energy change for the reaction?

- A -818 kJ/mol
- B -323 kJ/mol
- C $+323$ kJ/mol
- D $+818$ kJ/mol

- 13 Methanol is made by reacting carbon monoxide with hydrogen. The reaction is reversible.

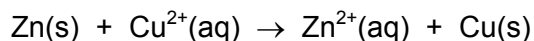


The forward reaction is exothermic.

Which combination of temperature and pressure gives the highest equilibrium yield of methanol?

| | temperature /°C | pressure /atmospheres |
|----------|--------------------|--------------------------|
| A | 200 | 10 |
| B | 200 | 200 |
| C | 600 | 10 |
| D | 600 | 200 |

- 14 The ionic equation for the reaction between zinc and aqueous copper ions is shown.



Which statement about this reaction is correct?

- A** Copper ions are oxidised and their oxidation state changes.
 - B** Copper ions are reduced because they lose electrons.
 - C** Zinc atoms are oxidised and their oxidation state changes.
 - D** Zinc atoms are reduced because they gain electrons.
- 15 In which reaction is the rate of reaction **not** affected by light?
- A** the conversion of carbon dioxide and water to glucose and oxygen in green plants
 - B** the reaction of bromine with ethene
 - C** the reaction of chlorine with methane
 - D** the reduction of silver ions to silver

- 16** Calcium carbonate reacts with dilute hydrochloric acid to form bubbles of carbon dioxide.

At a higher temperature, the same reaction is faster.

Which row explains this observation?

| | collision rate | number of molecules with sufficient energy to react |
|----------|----------------|---|
| A | increases | more |
| B | increases | the same |
| C | stays the same | more |
| D | stays the same | the same |

- 17** Ethanoic acid reacts with water to produce an acidic solution.

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

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

- 18** A solution of compound Z gives a light blue precipitate with aqueous ammonia. The precipitate dissolves in an excess of ammonia.

A flame test is done on compound Z.

What is the colour of the flame?

- A** blue-green
- B** lilac
- C** red
- D** yellow

- 19** Carbon, copper, magnesium, sodium and sulfur can all form oxides.

How many of these elements form acidic oxides?

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

20 Which method is used to make the salt copper(II) sulfate?

- A dilute acid + alkali
- B dilute acid + carbonate
- C dilute acid + metal
- D dilute acid + non-metal oxide

21 The Periodic Table lists all the known elements.

Elements are arranged in order of 1 number.

The melting points of Group I elements 2 down the group.

The melting points of Group VII elements 3 down the group.

Which words correctly complete gaps 1, 2 and 3?

| | 1 | 2 | 3 |
|----------|---------|----------|----------|
| A | nucleon | decrease | increase |
| B | nucleon | increase | decrease |
| C | proton | decrease | increase |
| D | proton | increase | decrease |

22 Metal X reacts with non-metal Y to form an ionic compound with the formula X_2Y .

Which statements are correct?

- 1 X is in Group I of the Periodic Table.
- 2 X is in Group II of the Periodic Table.
- 3 Y is in Group VI of the Periodic Table.
- 4 Y is in Group VII of the Periodic Table.

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

23 Which statements about Group I and Group VII elements are correct?

- 1 In Group I, lithium is more reactive than potassium.
- 2 In Group VII, chlorine is more reactive than fluorine.

| | statement 1 | statement 2 |
|----------|-------------|-------------|
| A | ✓ | ✓ |
| B | ✓ | x |
| C | x | ✓ |
| D | x | x |

24 Which two properties are physical properties of **all** pure metals?

| | property 1 | property 2 |
|----------|-------------------------------|------------------------|
| A | brittle | poor conductor of heat |
| B | good conductor of electricity | malleable |
| C | good conductor of heat | low melting point |
| D | malleable | low density |

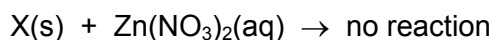
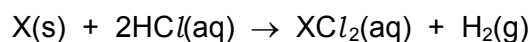
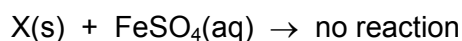
25 Aluminium is extracted from aluminium oxide using electrolysis.

Carbon dioxide is formed in this process.

Which equation shows the formation of carbon dioxide during the extraction of aluminium from aluminium oxide by electrolysis?

- A** $Al_2(CO_3)_3 \rightarrow Al_2O_3 + 3CO_2$
- B** $Al_2O_3 + 3CO \rightarrow 2Al + 3CO_2$
- C** $C + O_2 \rightarrow CO_2$
- D** $C^{4+} + 2O^{2-} \rightarrow CO_2$

26 A sample of solid X was added to three different solutions to predict the position of X in the reactivity series.



Which other solution would react with solid X?

- A** $CaSO_4(aq)$ **B** $CuSO_4(aq)$ **C** $MgSO_4(aq)$ **D** $Na_2SO_4(aq)$

27 Which statement about the uses of aluminium, copper and iron is correct?

- A Aluminium is used for aircraft manufacture because it has a high density.
- B Aluminium is used for food containers because it is a good conductor of electricity.
- C Copper is used for cooking utensils because it is a good conductor of heat.
- D Stainless steel is used for car bodies because it corrodes easily.

28 Air is a mixture of gases.

The melting and boiling points of some gases present in clean, dry air are shown.

In the fractional distillation of liquid air, which gas boils first?

| | gas | melting point/°C | boiling point/°C |
|---|----------|------------------|------------------|
| A | argon | -189 | -186 |
| B | krypton | -157 | -153 |
| C | nitrogen | -210 | -196 |
| D | oxygen | -219 | -183 |

29 Water must be purified before it is suitable for use in the home.

Which processes are used to remove solid impurities and to kill bacteria?

| | to remove solid impurities | to kill bacteria |
|---|----------------------------|------------------|
| A | chlorination | chlorination |
| B | chlorination | filtration |
| C | filtration | chlorination |
| D | filtration | filtration |

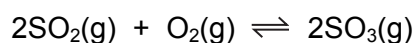
30 Which processes do **not** produce carbon dioxide?

- 1 heating limestone
- 2 burning gasoline in car engines
- 3 photosynthesis
- 4 production of nylon

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

- 31 Which pair of compounds would make an NPK fertiliser?
- A ammonium sulfate and potassium phosphate
 - B calcium hydroxide and ammonium nitrate
 - C calcium phosphate and potassium chloride
 - D potassium nitrate and ammonium sulfate
- 32 Which pollutant gas is produced by the decomposition of vegetation?
- A carbon monoxide
 - B methane
 - C nitrogen dioxide
 - D sulfur dioxide

- 33 The equation for the formation of sulfur trioxide from sulfur dioxide is shown.

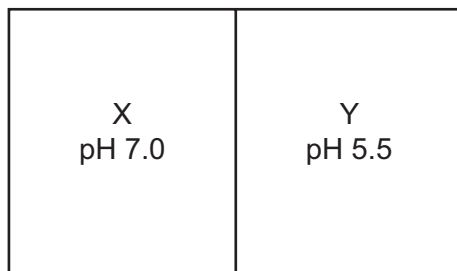


The forward reaction is exothermic.

Which combination of pressure and temperature gives the highest equilibrium yield of sulfur trioxide?

| | pressure | temperature |
|---|----------|-------------|
| A | high | high |
| B | high | low |
| C | low | high |
| D | low | low |

- 34 The diagram shows the pH values of the soil in two parts of a garden, X and Y.



Lime is used to neutralise the soil in one part of the garden.

To which part of the garden should the lime be added and why?

| | part of the garden | because lime is |
|----------|--------------------|-----------------|
| A | X | acidic |
| B | X | basic |
| C | Y | acidic |
| D | Y | basic |

- 35 Statement 1 Hydrogen is used as a fuel.

Statement 2 When hydrogen burns in the air to form water, heat energy is produced.

Which is correct?

- A** Both statements are correct and statement 2 explains statement 1.
B Both statements are correct but statement 2 does not explain statement 1.
C Statement 1 is correct but statement 2 is incorrect.
D Statement 2 is correct but statement 1 is incorrect.
- 36 Which row identifies compounds in the same homologous series?

| | chemical properties | functional group |
|----------|---------------------|------------------|
| A | different | different |
| B | different | same |
| C | similar | different |
| D | similar | same |

37 Three chemical reactions are shown.

- 1 catalytic addition of steam to ethene
- 2 combustion of ethanol
- 3 fermentation of glucose

In which of the reactions does the relative molecular mass of the carbon-containing compound decrease?

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

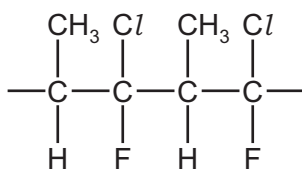
38 How is ethanol produced by fermentation?

- A** using anaerobic conditions at 30 °C
B using anaerobic conditions at 450 °C
C using steam at 30 °C
D using steam at 450 °C

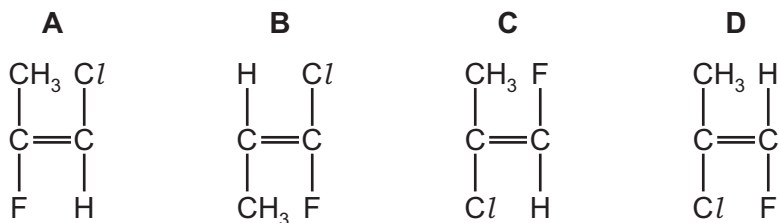
39 Which substances react together to form ethyl propanoate?

- A** ethanoic acid and propanol
B ethanol and propene
C ethene and propanol
D propanoic acid and ethanol

40 The structure of a chlorofluorocarbon polymer is shown.



Which monomer is used to make this polymer?



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The Periodic Table of Elements

| | | Group | | | | | | | | |
|-----------------------------------|------------------------------------|--|------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|------------------------------------|-------------------------------|-------------------------------|---------------------------------|
| I | II | III | IV | V | VI | VII | VIII | | | |
| 3 Li lithium 7 | 4 Be beryllium 9 | <div style="border: 1px solid black; padding: 5px; text-align: center;"> Key atomic number atomic symbol name relative atomic mass </div> | | | | | | 2 He helium 4 | | |
| 11 Na sodium 23 | 12 Mg magnesium 24 | | | | | | | 5 B boron 11 | 6 C carbon 12 | 7 N nitrogen 14 |
| 19 K potassium 39 | 20 Ca calcium 40 | 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 | | | |
| 37 Rb rubidium 85 | 38 Sr strontium 88 | 31 Ga gallium 70 | 32 Ge germanium 73 | 33 As arsenic 75 | 34 Se selenium 79 | 35 Br bromine 80 | 36 Kr krypton 84 | | | |
| 55 Cs caesium 133 | 56 Ba barium 137 | 49 In indium 115 | 50 Sn tin 119 | 51 Sb antimony 122 | 52 Te tellurium 128 | 53 I iodine 127 | 54 Xe xenon 131 | | | |
| 87 Fr francium — | 88 Ra radium — | 81 Tl thallium 204 | 82 Pb lead 207 | 83 Bi bismuth 209 | 84 Po polonium — | 85 At astatine — | 86 Rn radon — | | | |
| | | 29 Cu copper 64 | 30 Zn zinc 65 | 47 Ag silver 108 | 48 Cd cadmium 112 | 79 Hg mercury 201 | 80 Tl thallium 204 | | | |
| | | 26 Fe iron 56 | 27 Co cobalt 59 | 45 Rh rhodium 103 | 46 Pd palladium 106 | 77 Ir iridium 192 | 78 Pt platinum 195 | | | |
| | | 25 Mn manganese 55 | 28 Ni nickel 59 | 44 Ru ruthenium 101 | 45 Rh rhodium 103 | 76 Os osmium 190 | 77 Ir iridium 192 | | | |
| | | 24 Cr chromium 52 | 25 Mn manganese 55 | 44 Ru ruthenium 101 | 45 Rh rhodium 103 | 76 Os osmium 190 | 77 Ir iridium 192 | | | |
| | | 23 V vanadium 51 | 24 Cr chromium 52 | 41 Nb niobium 93 | 42 Mo molybdenum 96 | 74 W tungsten 184 | 75 Re rhenium 186 | | | |
| | | 22 Ti titanium 48 | 23 V vanadium 51 | 41 Nb niobium 93 | 42 Mo molybdenum 96 | 74 W tungsten 184 | 75 Re rhenium 186 | | | |
| | | 21 Sc scandium 45 | 22 Ti titanium 48 | 40 Zr zirconium 91 | 41 Nb niobium 93 | 73 Ta tantalum 181 | 74 W tungsten 184 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
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| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 72 Hf hafnium 178 | 73 Ta tantalum 181 | | | |
| | | 19 K potassium 39 | 20 Ca calcium 40 | 39 Y yttrium 89 | 40 | | | | | |