Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES **0654/21**

Paper 2 Multiple Choice (Extended) **October/November 2017**

45 minutes

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

READ THESE INSTRUCTIONS FIRST

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

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

Read the instructions on the Answer Sheet very carefully.

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

1 What is homeostasis?

A the maintenance of the body's external environment

B the maintenance of the body's internal environment

C the processes that produce heat in the body

D the removal of wastes from the body

2 What is excretion?

A breakdown of materials in kidney cells

B chemical reactions in liver cells

C removal of undigested food from the gut

D removal of waste products

3 What could deforestation cause?

A a decrease in carbon dioxide levels and a decrease in flooding

B a decrease in carbon dioxide levels and an increase in flooding

C an increase in carbon dioxide levels and a decrease in flooding

D an increase in carbon dioxide levels and an increase in flooding

4 Which statements about X chromosomes in humans are correct?

	present in body cells in males	present in body cells of females	carry genes
A	✓	✓	✓
B	✓	✗	✓
C	✓	✗	✗
D	✗	✓	✗

5 A child blows into a rubber balloon.

What is the percentage of oxygen inside the balloon?

A 0% **B** 4% **C** 16% **D** 21%

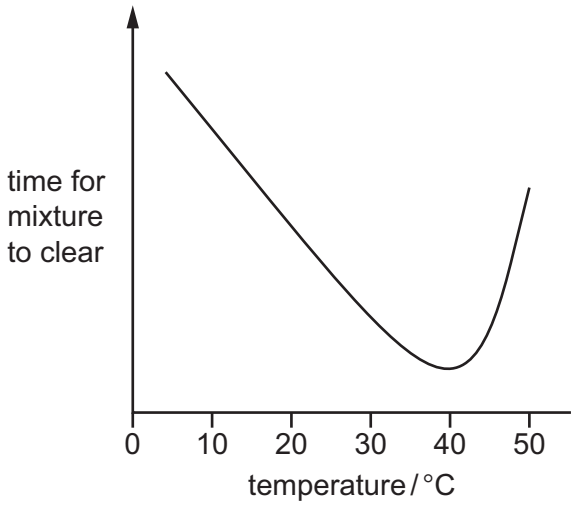
6 The maternal blood leaving the placenta is different in composition from that arriving.

What are those differences?

	oxygen	carbon dioxide	glucose
A	less	more	less
B	less	more	same
C	more	less	more
D	more	less	same

7 When a suspension of powdered milk is completely digested by a protease enzyme it becomes clear.

The graph shows the time taken for a mixture of protease and powdered milk to clear at different temperatures.



What is this enzyme's optimum temperature?

A 5 °C **B** 37 °C **C** 40 °C **D** 50 °C

8 What is the equation for photosynthesis?

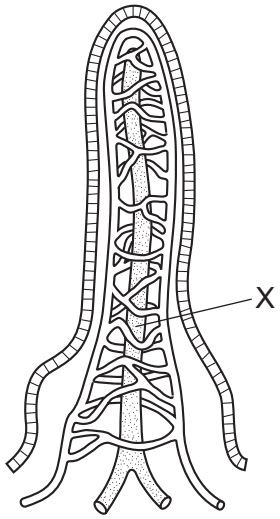
A $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

B $6CO_2 + C_6H_{12}O_6 \rightarrow 6O_2 + 6H_2O$

C $6O_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6CO_2$

D $6O_2 + C_6H_{12}O_6 \rightarrow 6CO_2 + 6H_2O$

9 The diagram shows a section through a villus.



What is the function of structure X?

A to absorb amino acids from the intestine

B to absorb fatty acids from the intestine

C to transport enzymes to the intestine

D to transport water to the intestine

10 Why do food chains usually have fewer than five trophic levels?

A All the carnivores consume herbivores.

B The energy passed on reduces from one trophic level to the next.

C There is less protein in each individual higher up the chain.

D There is only one producer in each chain.

11 What is osmosis?

A the diffusion of sugar molecules from a concentrated solution to a dilute solution through a partially permeable membrane

B the diffusion of sugar molecules from a dilute solution to a concentrated solution through a partially permeable membrane

C the diffusion of water molecules from a concentrated solution to a dilute solution through a partially permeable membrane

D the diffusion of water molecules from a dilute solution to a concentrated solution through a partially permeable membrane

12 Water enters root hair cells from the soil.

What happens to most of this water after it has entered the cells?

A It is used in photosynthesis in the root cells.

B It moves out again when the soil is dry.

C It moves to the leaves and is lost by transpiration.

D The cell uses it in respiration.

13 Mitosis is a process of nuclear division.

What happens to the chromosome number in this process?

A It is halved from diploid to haploid.

B It is halved from haploid to diploid.

C It is maintained by the exact duplication of chromosomes.

D It is maintained by the exact fusion of chromosomes.

14 Which row describes the melting point and boiling point of salt water?

	melting point / °C	boiling point / °C
A	0	less than 100
B	0	100
C	less than 0	more than 100
D	more than 0	100

[Turn over

15 A student completes four experiments.

Experiment 1 The student heats some ice and it melts.

Experiment 2 The student heats some blue copper sulfate crystals and a white solid is formed. Steam is given off.

Experiment 3 The student grinds up a lump of chalk to a powder.

Experiment 4 The student heats green copper carbonate crystals and a black solid is formed. A gas is produced that turns limewater milky.

Which row describes the changes in the experiments?

	physical changes	chemical changes
A	1 and 3	2 and 4
B	1 and 4	2 and 3
C	2 and 3	1 and 4
D	2 and 4	1 and 3

16 Which two ionic compounds have a relative formula mass of 62?

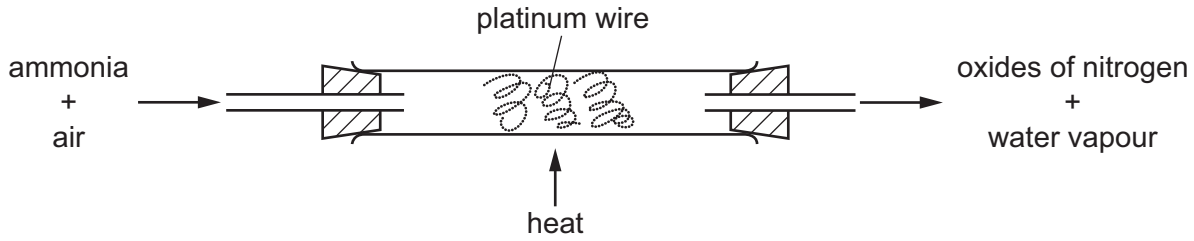
A $Al F_3$ and AlN

B AlN and Na_2O

C MgF_2 and $Al F_3$

D MgF_2 and Na_2O

17 Ammonia is oxidised as shown.



The platinum is chemically unchanged at the end of the reaction.

What is the reason for using platinum?

A to absorb the heat from the reaction

B to filter out oxygen from the air

C to increase the rate of the reaction

D to neutralise the ammonia

18 Which changes take place at the electrodes during electrolysis?

	anode	cathode
A	negatively charged ions gain electrons	positively charged ions lose electrons
B	negatively charged ions lose electrons	positively charged ions gain electrons
C	positively charged ions gain electrons	negatively charged ions lose electrons
D	positively charged ions lose electrons	negatively charged ions gain electrons

19 Which substances react with dilute sulfuric acid to form a salt?

	magnesium	magnesium oxide	magnesium carbonate	magnesium chloride
A	✓	✓	✓	✗
B	✓	✓	✗	✓
C	✓	✗	✓	✓
D	✗	✓	✓	✓

20 Which trend is observed as the Periodic Table is crossed from left to right?

A The elements change from metallic to non-metallic and the oxides of the elements change from acidic to basic.

B The elements change from metallic to non-metallic and the oxides of the elements change from basic to acidic.

C The elements change from non-metallic to metallic and the oxides of the elements change from acidic to basic.

D The elements change from non-metallic to metallic and the oxides of the elements change from basic to acidic.

[Turn over

21 Rubidium is below potassium in Group I of the Periodic Table.

Which row describes the properties of rubidium?

	melting point	reaction with water
A	higher than potassium	faster than potassium
B	higher than potassium	slower than potassium
C	lower than potassium	faster than potassium
D	lower than potassium	slower than potassium

22 In the blast furnace, which substance is added to make slag?

A calcium carbonate

B carbon dioxide

C carbon monoxide

D coke

23 What are the sources of hydrogen and nitrogen used in the Haber process?

	hydrogen	nitrogen
A	air	ammonia
B	ethanol	air
C	hydrocarbons	air
D	steam	ammonia

24 The Contact process is used to manufacture sulfuric acid.

Which statement about the Contact process is **not** correct?

A An iron catalyst is used.

B Sulfur dioxide reacts with oxygen to form sulfur trioxide.

C Sulfur burns to form sulfur dioxide.

D Sulfur trioxide dissolves in concentrated sulfuric acid to form oleum.

25 Which word equation describes the manufacture of lime from limestone?

A calcium carbonate → calcium hydroxide + carbon dioxide

B calcium carbonate → calcium oxide + carbon dioxide

C calcium hydroxide → calcium oxide + water

D calcium oxide + carbon dioxide → calcium carbonate

26 What are the products of the **complete** combustion of ethanol?

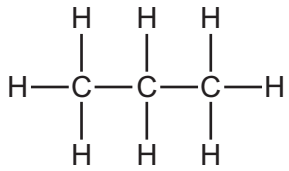
A carbon dioxide + carbon monoxide + water

B carbon dioxide + hydrogen

C carbon dioxide + water

D carbon monoxide + water

27 The structure of a hydrocarbon is shown.



What is the name of this hydrocarbon?

A butane

B butene

C propane

D propene

28 A car moves with a constant speed of 15 m / s along a road for 20 s.

After this, the car is 100 m from where it started, measured in a straight line.

Which statement about the car is correct?

A It has travelled a distance of 100 m along the road.

B It has travelled a distance of 300 m along the road.

C Its direction was constant.

D Its velocity was constant.

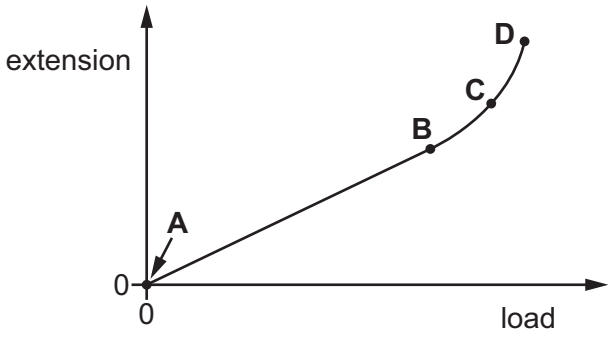
29 An astronaut travels from Earth to the Moon. The gravitational field strength on the Moon is less than that on Earth.

How do the mass and weight of the astronaut on the Moon compare with his mass and weight on Earth?

	mass	weight
A	less than on Earth	less than on Earth
B	less than on Earth	the same as on Earth
C	the same as on Earth	less than on Earth
D	the same as on Earth	the same as on Earth

30 A load is applied to a copper wire. The graph shows how the extension changes as the load changes.

Which labelled point on the graph is the limit of proportionality?



31 A worker carries bricks up a ladder.

The following quantities are known.

- the height the bricks are lifted up
- the time taken for the worker to lift the bricks
- the volume of the bricks
- the weight of the bricks

Which quantities are needed to calculate the useful power produced by the worker as he carries the bricks up the ladder?

A height, time and volume

B height, time and weight

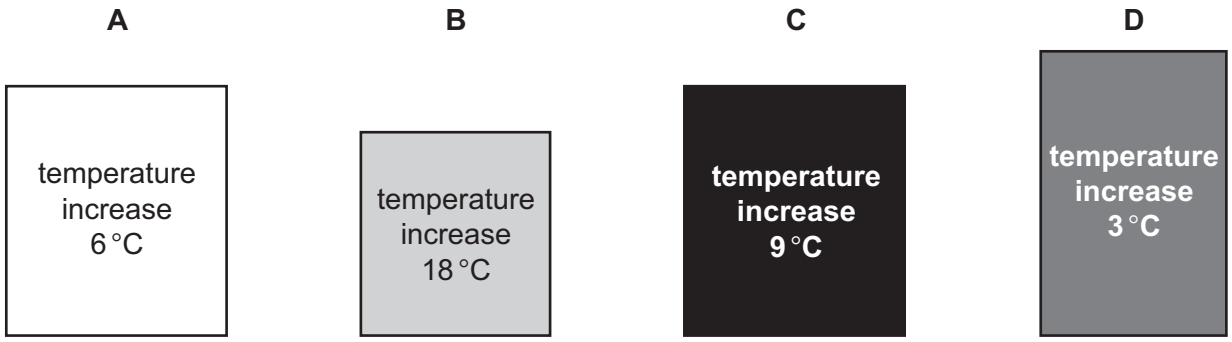
C height, volume and weight

D time, volume and weight

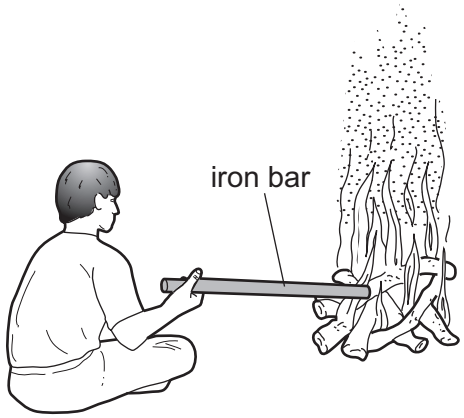
32 Thermal energy is supplied to four different blocks. The gain in thermal energy is the same for each block.

The temperature increase produced is shown on each block.

Which block has the greatest thermal capacity?



33 A boy sits near a campfire. He holds an iron bar with one end in the fire. His hand becomes hot.



In which ways does thermal energy (heat) from the fire reach his hand?

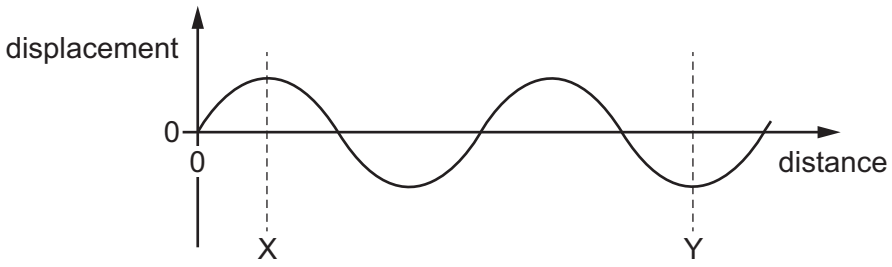
A conduction and convection only

B conduction and radiation only

C convection and radiation only

D conduction, convection and radiation

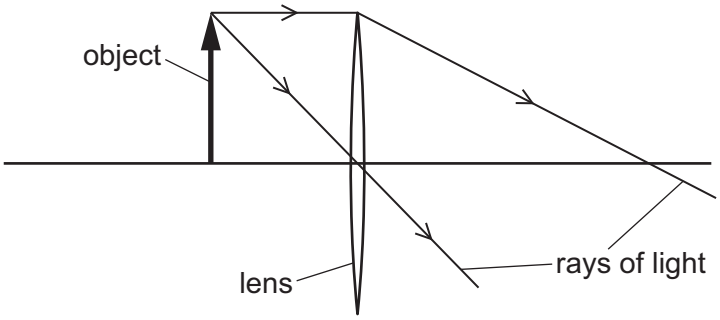
34 The diagram represents a wave.



How many wavelengths are there between X and Y?

A $\frac{2}{3}$ **B** 1 **C** $1\frac{1}{2}$ **D** 3

35 The diagram shows two rays of light that have passed from an object through a thin converging lens. An image is formed.



Which statement about the image is correct?

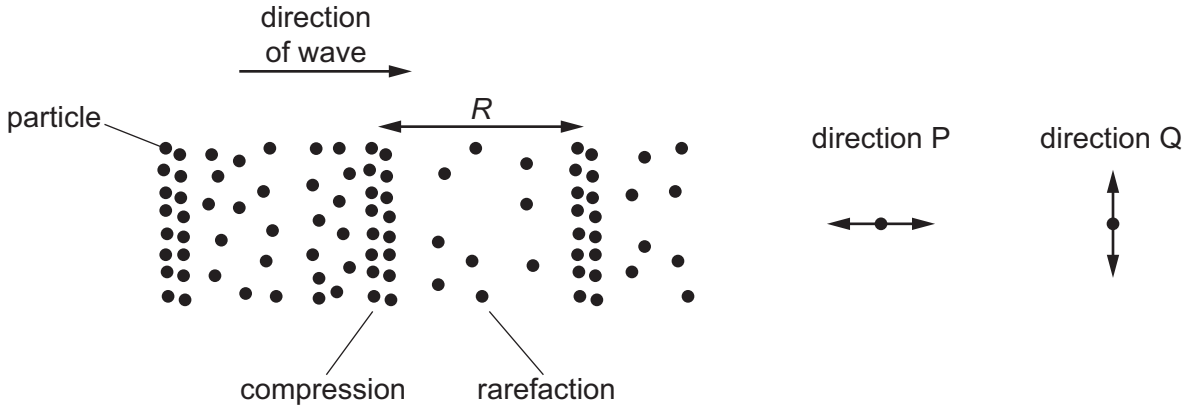
A It is inverted and real.

B It is inverted and virtual.

C It is upright and real.

D It is upright and virtual.

36 The diagram represents a sound wave of wavelength λ in air. A compression and a rarefaction of the wave are labelled.

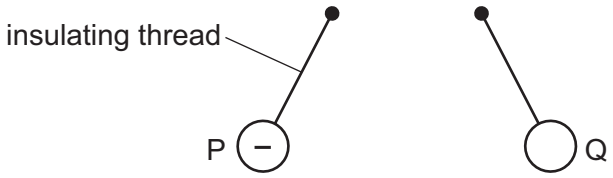


What does the length *R* equal, and in which labelled direction do the air particles vibrate as the sound wave passes?

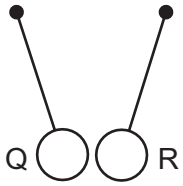
	R is equal to	direction of vibration
A	λ	P
B	λ	Q
C	2λ	P
D	2λ	Q

37 Three charged balls P, Q and R are suspended by insulating threads. Ball P is negatively charged.

Ball Q is brought close to ball P. The balls move away from each other.



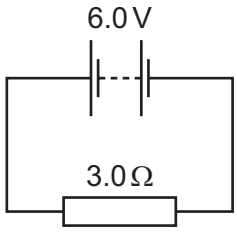
Ball Q is now brought close to ball R. The balls move closer to each other.



What are the signs of the charges on ball Q and ball R?

	ball Q	ball R
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

38 The diagram shows a 3.0 Ω resistor connected to a 6.0 V battery.

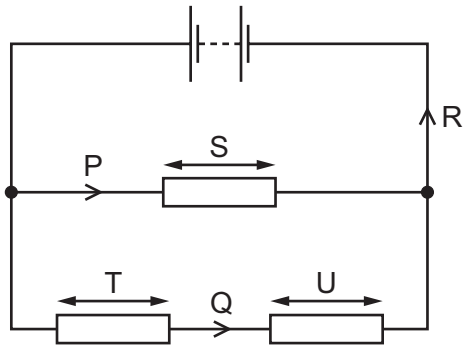


How much energy is transferred in the 3.0 Ω resistor in 30 seconds?

A 15 J **B** 60 J **C** 360 J **D** 540 J

39 The circuit in the diagram contains three resistors.

Currents P, Q and R, and potential differences S, T and U are labelled.

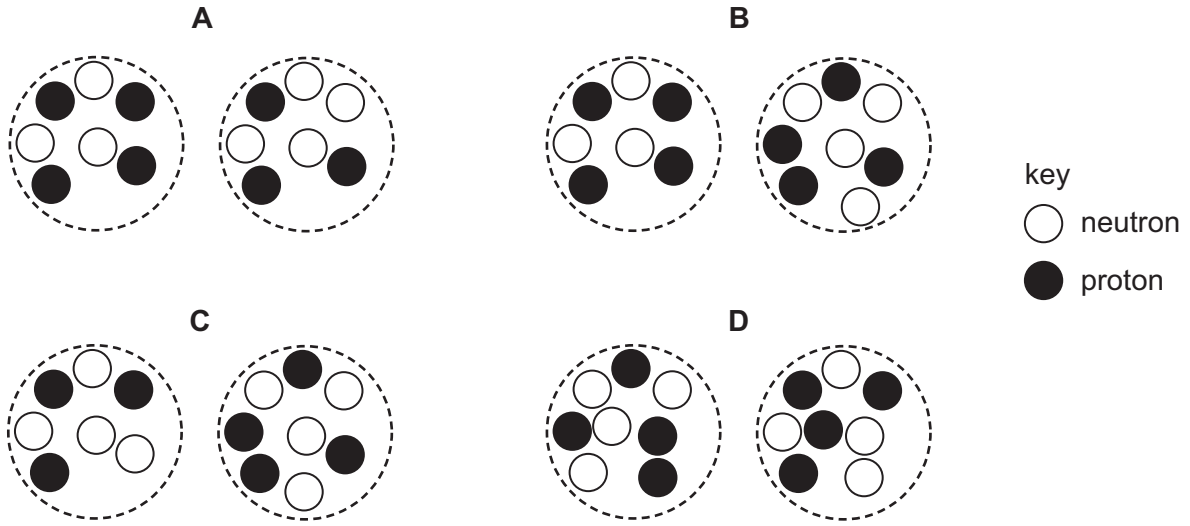


Which row shows the relationship between the currents and between the potential differences?

	currents	potential differences
A	P + Q = R	S = T + U
B	P + Q = R	S = T = U
C	P = Q = R	S = T + U
D	P = Q = R	S = T = U

40 The diagrams represent pairs of nuclei of some atoms.

Which pair shows nuclei of different isotopes of the same element?



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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).