

ORCHID PARK SECONDARY SCHOOL

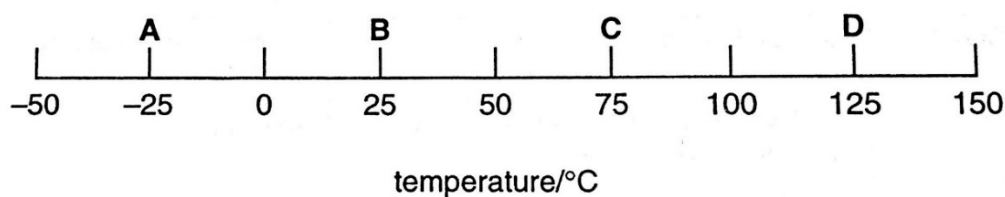
Section A: Multiple Choice Questions [40 marks]

1 Which apparatus is most suitable for measuring 17 cm^3 of carbon dioxide gas?

- A Burette
- B Pipette
- C Gas jar
- D Gas syringe

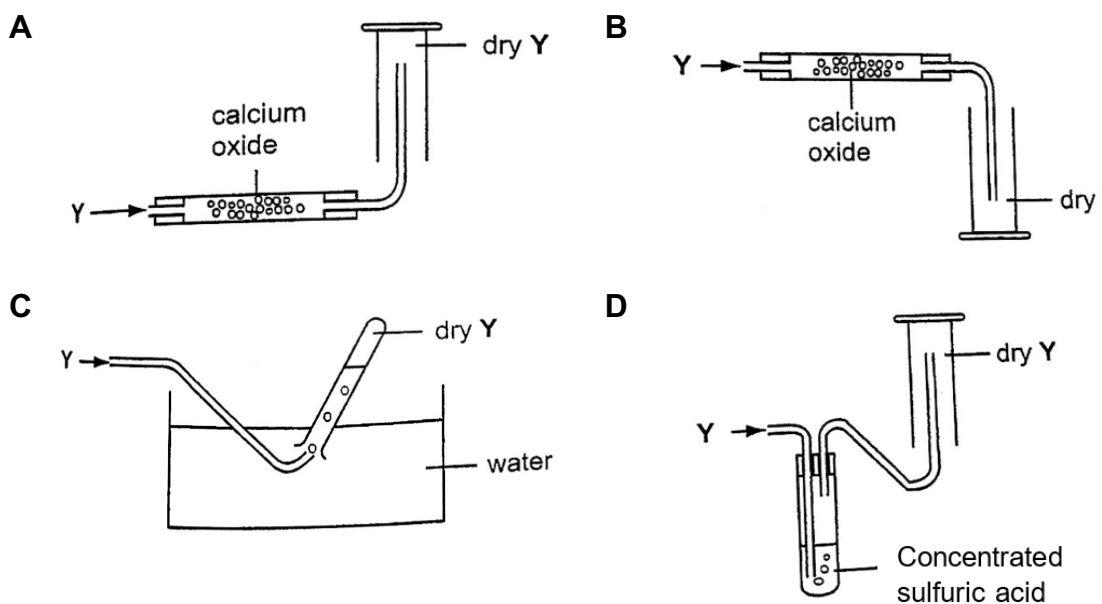
2 Bromine has a melting point of -2°C and a boiling point of 59°C .

At which temperature is bromine a liquid?

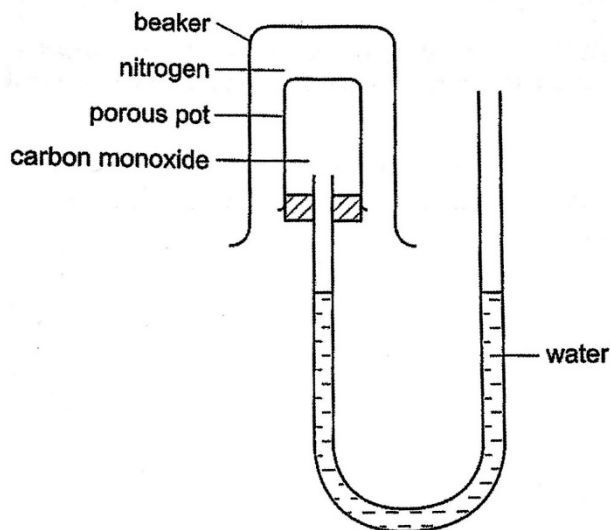


3 A gas Y, is less dense than air, very soluble in water and is an alkali.

Which method is used to collect a dry sample of the gas?



- 4 A beaker of nitrogen was inverted over a porous pot, containing carbon monoxide as shown. The water level did not change.



What is the reason for this?

- A Both gases are diatomic.
 - B Nitrogen is an inert gas.
 - C The gas particles are too large to pass through the porous pot.
 - D The two gases have the same density.
- 5 When concentrated aqueous ammonia and concentrated hydrochloric acid are placed at opposite ends of a tube, a white ring of ammonium chloride forms nearer to the hydrochloric acid.



Which conclusion about this experiment is correct?

- A The reactivity of ammonia is less than that of hydrogen chloride.
- B The boiling point of ammonia is less than that of hydrogen chloride.
- C The concentration of the aqueous ammonia is less than that of the acid.
- D The relative molecular mass of ammonia is less than that of hydrogen chloride.

- 6 Two solutions, **Y** and **Z**, were tested as shown.

	Y	Z
Dilute sulfuric acid added	White precipitate	No visible change
Dilute nitric acid added, then barium nitrate	No visible change	White precipitate
Aqueous sodium hydroxide and aluminium foil added, then warmed	Gas given off turns red litmus blue	No gas given off
Aqueous ammonia added	White precipitate, insoluble in excess	White precipitate, soluble in excess, forming a colourless solution

What are solutions **Y** and **Z**?

	Y	Z
A	Ammonium sulfate	Zinc sulfate
B	Lead(II) nitrate	Aluminium sulfate
C	Lead(II) nitrate	Zinc sulfate
D	Zinc nitrate	Aluminium sulfate

- 7 A student was trying to obtain copper(II) sulfate crystals by reacting copper(II) oxide with dilute sulfuric acid.

Instead of blue crystals, his final product was a white compound.

What mistake did the student make?

- A** Heating the filtrate to dryness
- B** Adding excess copper (II) oxide
- C** Using excess dilute sulfuric acid
- D** Using dilute sulfuric acid instead of concentrated sulfuric acid

8 Three separations are listed.

1: Obtaining water from sodium chloride solution

2: Obtaining iodine from a mixture of iodine and nickel

3: Obtaining solid sodium chloride from aqueous sodium chloride

Which techniques would be involved in these separations?

	1	2	3
A	Distillation	Sublimation	Evaporation
B	Distillation	Sublimation	Crystallisation
C	Filtration	Crystallisation	Evaporation
D	Sublimation	Filtration	Crystallisation

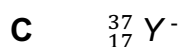
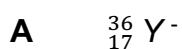
9 The table shows the number of protons, neutrons and electrons in four ions.
For which ion is the data correct?

	Ion	Number of		
		protons	neutrons	electrons
A	${}^6_4\text{Be}^{2+}$	4	6	2
B	${}^{24}_{12}\text{Mg}^{2+}$	12	12	10
C	${}^{14}_7\text{N}^{3-}$	7	7	4
D	${}^{23}_{11}\text{Na}^{+}$	11	12	12

10 An isotope of element X can be written as ${}^{32}_{16}\text{X}$.

Particle Y has four more neutrons, one more proton and one more electron than this isotope of X.

What represents Y?



-

- A** $2\text{CH}_2\text{O}$
- B** $\text{C}_2\text{H}_4\text{O}_2$
- C** $\text{C}_2(\text{OH})_2$
- D** $\text{C}_4\text{H}_2\text{O}_2$

- 13** Which of the following consists of the greatest number of atoms?
- A** 6 g of hydrogen gas
- B** 48 g of magnesium
- C** 71 g of chlorine gas
- D** 72 dm³ of argon gas at r.t.p.

- 8.0 g of Y_2O_3 contains 5.6 g of Y.

How many moles of Y does 5.6 g of the element contain?

- A** $\frac{2.4}{16} \times \frac{2}{3}$ **B** $\frac{2.4}{16} \times \frac{3}{2}$ **C** $\frac{8}{16} \times \frac{2}{3}$ **D** $\frac{8}{16} \times \frac{3}{2}$

- 15** 6.0 dm^3 of CO_2 was evolved at room temperature and pressure when adding 50 g of impure limestone, CaCO_3 , to excess hydrochloric acid, HCl .
What is the purity of the limestone?

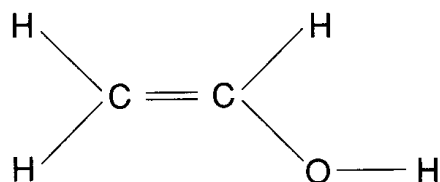
A	25%	B	50%
C	75%	D	100%

- 16** Both calcium chloride and potassium chloride are ionic compounds.
Which statements about these compounds are correct?

1. Potassium chloride has a higher melting point than calcium chloride because the potassium ion has a greater charge than the calcium ion.
2. In the calcium chloride lattice, the ratio of calcium ions to chloride ions is half that of the ratio of potassium ions to chloride ions in the potassium chloride lattice.
3. Molten calcium chloride has a greater electrical conductivity than molten potassium chloride because calcium contributes more electrons to the delocalised “sea of electrons” than potassium.

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

- 17** How many electrons are there in the covalent bonds in the following compound?



A	7	B	12
C	14	D	24

18 In which molecule are **all** the outer electrons of the atoms involved in bonding?

A HF

B H₂O

C NH₃

D CH₄

19 Which bonding does **not** correspond to its description of physical properties?

	<i>bonding type</i>	<i>electronic configuration</i>
A	giant covalent	high melting point, conducts electricity when in solution but not when solid
B	simple covalent	low melting point, does not conduct electricity in any state
C	metallic	Both high and low melting points, conducts electricity when solid and when molten
D	ionic	high melting point, conducts electricity when molten but not when solid

20 For which does 1 mole of the metal have the most electrons in its “sea of electrons”?

A Barium

B Aluminium

C Sodium

D Potassium

21 Which of the following statements is/are incorrect?

1. The properties of an alloy are similar to the properties of its constituent metals.
2. Compounds are substances containing two or more atoms of the same type that are chemically combined.
3. A pure element melts at a fixed temperature but a pure compound melts at a range of temperatures.

A 2 only

B 1 and 2

C 1 and 3

D 2 and 3

- 22 Four substances have the following electrical properties.

Substance	Electrical Property
W	Does not conduct under any condition
X	Conducts only in aqueous solution
Y	Conducts in both the molten and solid states
Z	Conducts in both the molten and aqueous states

What are these four substances?

	W	X	Y	Z
A	HC/	S	NaCl	Pb
B	Pb	HC/	NaCl	S
C	S	HC/	Pb	NaCl
D	S	NaCl	HC/	Pb

- 23 The thermal stability of metal nitrates is related to the position of the metal in the reactivity series in the same way as carbonates.

Which metal nitrate, on heating, will decompose to form the metal?

- A** zinc nitrate
- B** silver nitrate
- C** potassium nitrate
- D** calcium nitrate

- 24 Element **Q** has the following properties.

- forms QC_3 when heated with chlorine
- forms QSO_4 when react with dilute sulfuric acid

To which part of the periodic Table does **Q** belong?

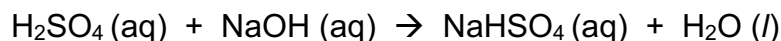
- A** Group II
- B** Group III
- C** Group IV
- D** Transition elements

- 25 A 0.2 mol/dm³ aqueous solution of phosphoric (V) acid is mixed with a 0.2 mol/dm³ aqueous solution of sodium hydroxide.

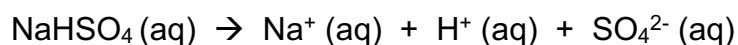
Which mixture will form the salt Na₃PO₄ **only**?

	<i>volume of 0.2 mol/dm³ phosphoric (V) acid</i>	<i>volume of 0.2 mol/dm³ sodium hydroxide</i>
A	5 cm ³	5 cm ³
B	5 cm ³	15 cm ³
C	15 cm ³	5 cm ³
D	20 cm ³	10 cm ³

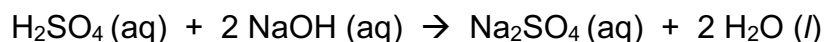
- 26 When dilute sulfuric acid and sodium hydroxide react, sodium hydrogen sulfate, NaHSO₄, is first formed.



Aqueous sodium hydrogen sulfate dissociates into ions.



If more sodium hydroxide is added, sodium sulfate, Na₂SO₄, can be formed.



Which results for these two salts, when tested with Universal Indicator and barium nitrate solution are correct?

		<i>pH</i>	<i>Addition of barium nitrate solution</i>
A	NaHSO ₄	> 7	no reaction
	Na ₂ SO ₄	7	no reaction
B	NaHSO ₄	> 7	white precipitate
	Na ₂ SO ₄	7	white precipitate
C	NaHSO ₄	< 7	no reaction
	Na ₂ SO ₄	7	no reaction
D	NaHSO ₄	< 7	white precipitate
	Na ₂ SO ₄	7	white precipitate

- 27** *Disproportionation* is a reaction in which the same element is both oxidised and reduced.

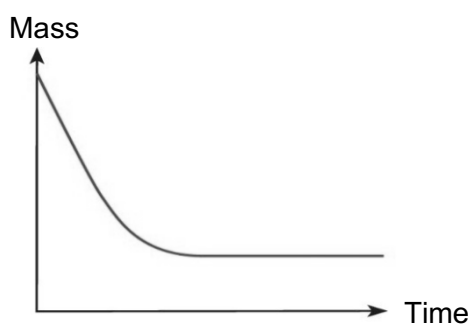
Which reaction is an example of *disproportionation*?

- A** $3 \text{ Cu} + 8 \text{ HNO}_3 \rightarrow 3 \text{ Cu}(\text{NO}_3)_2 + 2 \text{ NO} + 4 \text{ H}_2\text{O}$
B $\text{Cl}_2 + 2 \text{ NaOH} \rightarrow \text{NaCl} + \text{NaOCl} + \text{H}_2\text{O}$
C $\text{Fe}_2(\text{SO}_4)_3 + 2 \text{ KI} \rightarrow 2 \text{ FeSO}_4 + \text{K}_2\text{SO}_4 + \text{I}_2$
D $2 \text{ Pb}(\text{NO}_3)_2 \rightarrow 2 \text{ PbO} + 4 \text{ NO}_2 + \text{O}_2$

- 28** In which reaction does the oxidation state of iron remained unchanged?

- A** $2 \text{ Fe} + 3 \text{ Cl}_2 \rightarrow 2 \text{ FeCl}_3$
B $2 \text{ FeCl}_2 + \text{Cl}_2 \rightarrow 2 \text{ FeCl}_3$
C $\text{Fe} + 2 \text{ FeCl}_3 \rightarrow 3 \text{ FeCl}_2$
D $\text{Fe}_2\text{O}_3 + 6 \text{ HCl} \rightarrow 2 \text{ FeCl}_3 + 3 \text{ H}_2\text{O}$

- 29** Two reactants were mixed together in a beaker and the mass of the beaker and its contents was recorded at regular time intervals. A graph of mass plotted against time is shown below.



Which of the following are possible reactants?

- A** Sodium hydroxide and hydrochloric acid
B Copper sulfate and zinc
C Copper carbonate and hydrochloric acid
D Sodium hydroxide and copper sulfate

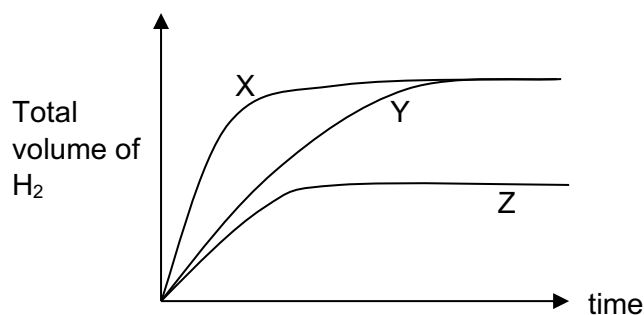
- 30** Dilute hydrochloric acid was reacted with 1.2g of magnesium ribbon at room temperature in two experiments, Experiment 1 and Experiment 2.

In Experiment 1, 100 cm³ of 1 mol/dm³ hydrochloric acid was used.

In Experiment 2, 50 cm³ of 2 mol/dm³ hydrochloric acid was used.

The volume of hydrogen given off was plotted against time.

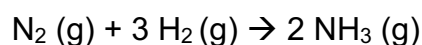
Which one of the following pairs of graph would be obtained in the two experiments?



Which one of the following pairs of curves would be obtained in the two experiments?

	<i>Experiment 1</i>	<i>Experiment 2</i>
A	Z	Y
B	Y	X
C	Y	Z
D	X	Y

- 31** In Haber process, nitrogen gas reacts with hydrogen gas to form ammonia gas, as shown in the equation below:



48 dm³ of hydrogen gas has reacted completely.

Which volume of ammonia gas will be formed at room temperature and pressure?

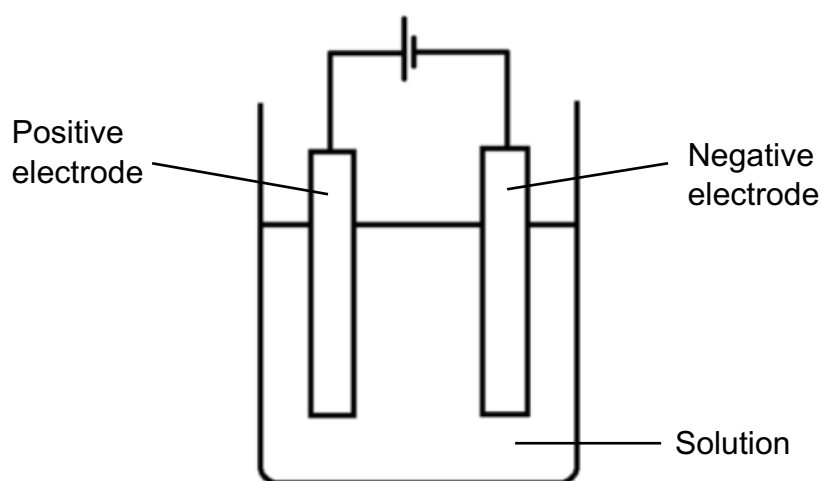
- | | | | |
|----------|--------------------|----------|--------------------|
| A | 24 dm ³ | B | 32 dm ³ |
| C | 48 dm ³ | D | 64 dm ³ |

- 32** Ammonia is manufactured by the Haber process, using an iron catalyst. It is not possible to obtain 100 % yield.

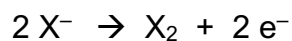
What is the reason for this?

- A** Nitrogen is unreactive.
- B** A high pressure is used.
- C** The reaction is reversible.
- D** The iron catalyst is poisoned by ammonia.

- 33** Four different solutions were electrolysed in separate experiments.



In one of the experiments, element X_2 was formed at the positive electrode. For which combination of solution and electrodes can the reaction for the formation of X_2 be represented by the equation shown below?



- A** Aqueous copper(II) sulfate with copper electrodes
- B** Aqueous copper(II) sulfate with inert electrodes
- C** Concentrated aqueous sodium chloride with inert electrodes
- D** Dilute aqueous sodium chloride with inert electrodes

- 34 Which of the following set-ups would have no change in the concentration of the electrolyte upon electrolysis?

	Electrolyte	Electrodes
A	Aqueous copper(II) sulfate	Carbon
B	Aqueous copper(II) sulfate	Platinum
C	Aqueous copper(II) chloride	Copper
D	Aqueous copper(II) chloride	Carbon

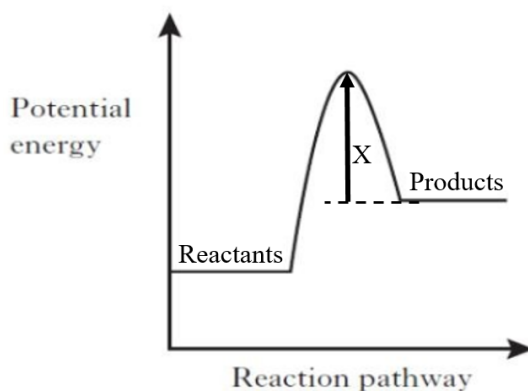
- 35 In an electrolysis experiment, the same amount of charge deposited 16g of copper and 6g of titanium. The charge on the copper ion was 2+.

[Ar: Ti, 48; Cu, 64]

What was the charge on the titanium ion?

- | | | | |
|----------|----|----------|----|
| A | 1+ | B | 2+ |
| C | 3+ | D | 4+ |

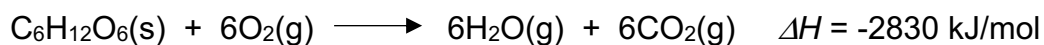
- 36 The energy profile diagram shows the energy changes that occurs as a reaction takes place.



From the diagram, which statement about the reaction is correct?

- A** The energy change when breaking bonds is greater than the energy change when making bonds.
- B** The equation for this reaction could be $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$.
- C** The reaction has a negative ΔH value.
- D** X is the activation energy for the reaction.

- 37 An equation for respiration is shown.



What can be deduced from the equation?

- A** Energy from sunlight is needed for this reaction.
- B** ΔH for photosynthesis is +2830 kJ/mol.
- C** Respiration is carried out by animals only.
- D** The equation shows the reaction between one volume of glucose and six volumes of oxygen to produce six volumes of carbon dioxide and six volumes of water.
- 38 How is the activation energy for a reaction between two gases changed when it is carried out either in the presence of a catalyst or when the temperature is increased?

	<i>Change in activation energy</i>	
	<i>Addition of catalyst</i>	<i>Increase in temperature</i>
A	decreases	decreases
B	decreases	stays the same
C	increases	decreases
D	increases	stays the same

- 39 The table gives the relative concentration of polluting gases in the air in four different industrialized cities.

In which city are limestone buildings most threatened by pollutants?

	<i>Sulfur dioxide</i>	<i>Nitrogen dioxide</i>	<i>ozone</i>
A	17	46	23
B	32	33	30
C	38	40	11
D	45	14	21

- 40** A catalytic converter in a car exhaust system changes pollutants into less harmful products.

Which change does **not** occur in a catalytic converter?

- A** carbon dioxide → carbon
- B** carbon monoxide → carbon dioxide
- C** nitrogen oxides → nitrogen
- D** unburnt hydrocarbons → carbon dioxide and water

END OF PAPER

The Periodic Table of Elements

Group																		
I	II											III	IV	V	VI	VII	0	
Key proton (atomic) number atomic symbol name relative atomic mass							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 F/ flerovium —		116 Lv livermorium —			

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
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 —

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.)