Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/21**

Paper 2 Multiple Choice (Extended) **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)

3070598259

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.

[Turn over

1 Which gas has the slowest rate of diffusion?

A H_2 **B** NH_3 **C** CH_4 **D** CO_2

2 A mixture of colourless amino acids is separated using chromatography.

The solvent used is propanol.

The chromatogram is sprayed with a locating agent.

Which row describes the purpose of the propanol and the locating agent?

	purpose of propanol	purpose of locating agent
A	to make the individual amino acids visible	to prevent the amino acids moving any further
B	to move the amino acids up the chromatography paper	to make the individual amino acids visible
C	to move the amino acids up the chromatography paper	to prevent the amino acids moving any further
D	to prevent the amino acids moving too far up the paper	to make the individual amino acids visible

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

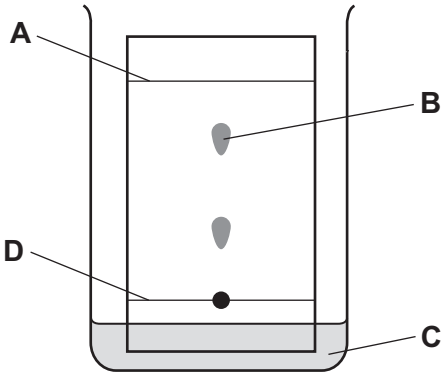
A 250 cm^3 beaker

B 50 cm^3 burette

C 100 cm^3 measuring cylinder

D 25 cm^3 pipette

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



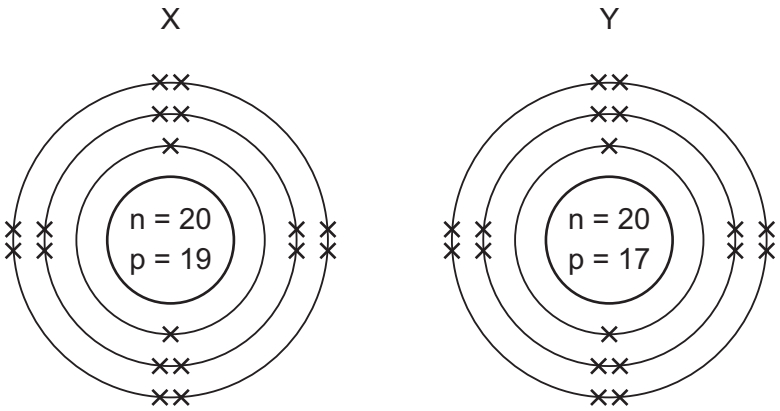
5 The atomic structure of four particles are shown.

	electrons	protons	neutrons
P	18	17	18
Q	18	17	20
R	17	17	18
S	17	17	20

Which particles have the same chemical properties?

A P and R only **B** P and S **C** P, Q and R **D** R and S

6 The arrangements of the electrons in two ions formed from elements X and Y are shown.



Which equation represents the reaction between elements X and Y?

A $X_2 + 2Y \rightarrow 2X^+ + 2Y^-$

B $X_2 + 2Y \rightarrow 2X^- + 2Y^+$

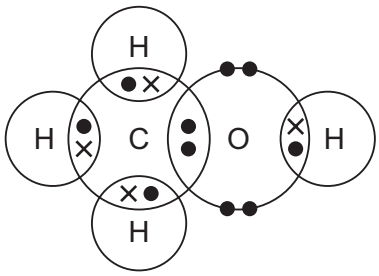
C $2X + Y_2 \rightarrow 2X^+ + 2Y^-$

D $2X + Y_2 \rightarrow 2X^- + 2Y^+$

[Turn over

7 Which diagram shows the outer shell electron arrangement in a molecule of methanol, CH_3OH?

A



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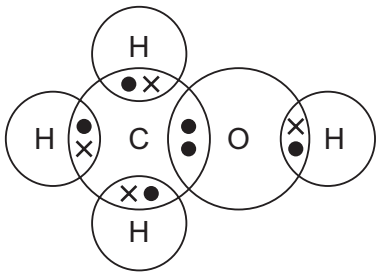

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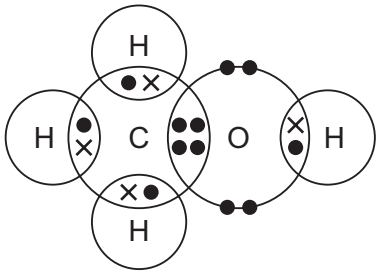

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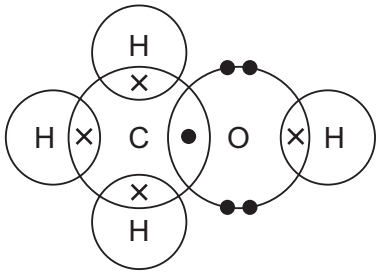


8 Which statement about silicon dioxide, SiO_2, is correct?

A It conducts electricity because it contains free electrons.

B It is a macromolecule with four oxygen atoms bonded to each silicon atom.

C It is a simple covalent molecule.

D Its structure is similar to graphite.

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
A	electron gained	Rb^+
B	electron gained	Rb^-
C	electron lost	Rb^+
D	electron lost	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 Sodium carbonate reacts with sulfuric acid to form carbon dioxide, water and a sodium salt.

An incomplete equation for the reaction is shown.

$$Na_2CO_3 + H_2SO_4 \rightarrow CO_2 + H_2O + ...$$

What is the formula of the sodium salt?

A $Na_2(SO_4)_2$ **B** $Na(SO_4)_2$ **C** Na_2SO_4 **D** $NaSO_4$

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 What is the empirical formula of an oxide of iron, formed by reacting 2.24 g of iron with 0.96 g of oxygen?

A FeO **B** Fe_2O **C** Fe_2O_3 **D** Fe_3O_4

14 Which reaction takes place at the cathode during the electrolysis of molten nickel(II) chloride?

A $Cl_2 + 2e^- \rightarrow 2Cl^-$

B $2Cl^- \rightarrow Cl_2 + 2e^-$

C $Ni \rightarrow Ni^{2+} + 2e^-$

D $Ni^{2+} + 2e^- \rightarrow Ni$

[Turn over

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
A	decreases	endothermic
B	decreases	exothermic
C	increases	endothermic
D	increases	exothermic

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

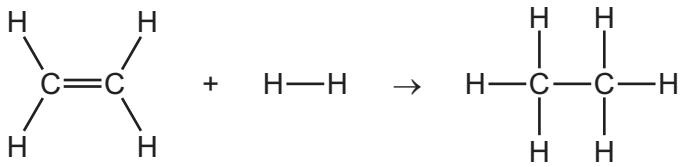
A coal

B hydrogen

C natural gas

D ^{235}U

17 Ethene reacts with hydrogen to form ethane.



The bond energies are shown in the table.

bond	bond energy in kJ / mol
C–C	+350
C–H	+410
H–H	+436
C=C	+614

What is the energy change for the reaction?

A –290 kJ / mol

B –120 kJ / mol

C +120 kJ / mol

D +290 kJ / mol

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 A student investigates the effect of concentration on the rate of reaction between calcium carbonate and hydrochloric acid. He follows the method shown.

- Place 1 g of calcium carbonate in a conical flask.
- Add excess hydrochloric acid.
- Let the reaction continue until no more gas is made.
- Repeat the experiment with different concentrations of hydrochloric acid.

Which essential step has been left out of the method if he is to work out the rate of the reaction?

A heating the reaction mixture

B placing a bung in the flask

C timing the reaction

D using a catalyst

[Turn over

20 The reaction between sulfur dioxide and oxygen is shown.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The reaction is exothermic.

Which of the changes shifts the position of equilibrium to the right?

1 Increase the concentration of oxygen.

2 Increase the pressure.

3 Increase the temperature.

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

21 The reaction between chlorine and bromide ions is a redox reaction.

$$Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$$

What is the change in oxidation state of the reducing agent in this reaction?

A –2 to 0 **B** –1 to 0 **C** 0 to –1 **D** 0 to +1

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.

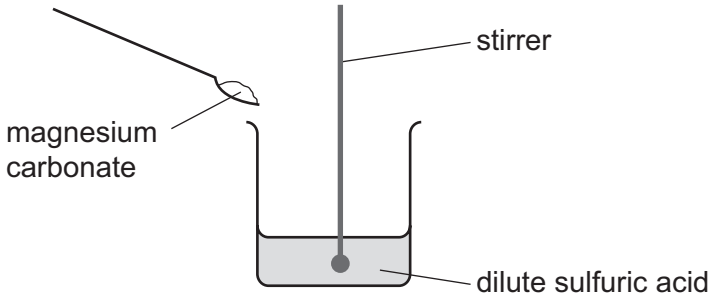
23 Zinc oxide is an amphoteric oxide.

Which row describes the reactions of zinc oxide?

	reaction with alkalis	reaction with acids
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

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 Elements P and Q have the same number of electron shells.

Q has more electrons in its outer shell than P.

Which statements are correct?

1 P and Q are in the same group of the Periodic Table.

2 P and Q are in the same period of the Periodic Table.

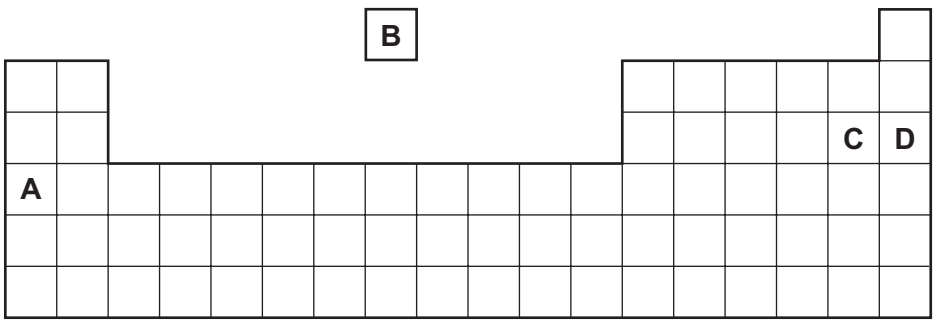
3 P has a greater tendency to form positive ions than Q.

4 The oxides of Q are more basic than those of P.

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

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

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



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

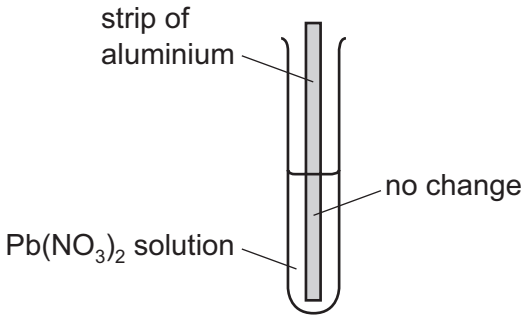
B hydrogen

C methane

D oxygen

28 A strip of aluminium is placed into a test-tube containing aqueous lead(II) nitrate and left for several minutes.

Aluminium is higher than lead in the reactivity series.



Which statement explains why lead is **not** displaced by this strip of aluminium?

A A thin insoluble layer of aluminium nitrate forms on the aluminium.

B Nitrate ions are reduced in aqueous solution.

C The ionic bonds between lead and nitrate ions are too strong.

D There is an unreactive oxide layer on the aluminium.

29 Which statements about the metal zinc are correct?

1 It is extracted from the ore bauxite.

2 It is used to galvanise steel.

3 It is used to make the alloy brass.

4 It reacts with dilute hydrochloric acid to produce hydrogen gas.

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

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

A A*l* **B** Cu **C** Fe **D** Zn

31 Ammonia is manufactured using the Haber process.

Which statement about this process is correct?

A The catalyst used for this reaction is vanadium pentoxide.

B The hydrogen used is extracted from air.

C Using a high pressure increases the yield of ammonia.

D Using a high temperature increases the yield of ammonia.

32 Iron can be protected from rusting by attaching a piece of a more reactive metal, e.g. magnesium, to the iron.

Which equation represents the reaction that takes place?

A $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

B $Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$

C $Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$

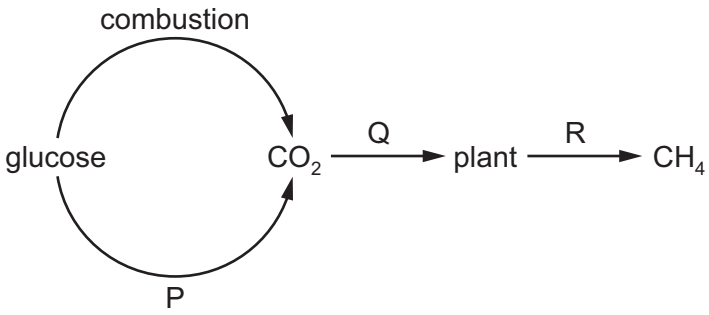
D $Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$

33 Which row describes two uses of sulfur dioxide?

	use 1	use 2
A	bleaching paper pulp	neutralising acidic industrial waste
B	bleaching paper pulp	preserving food and drink
C	extracting iron from hematite	neutralising acidic industrial waste
D	extracting iron from hematite	preserving food and drink

[Turn over

34 Part of the carbon cycle is shown.

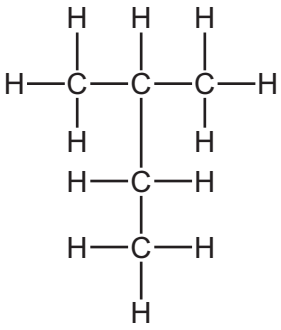


What are processes P, Q and R?

	P	Q	R
A	decomposition	respiration	photosynthesis
B	respiration	photosynthesis	decomposition
C	respiration	decomposition	photosynthesis
D	photosynthesis	respiration	decomposition

35 The structures of four organic molecules are shown.

1



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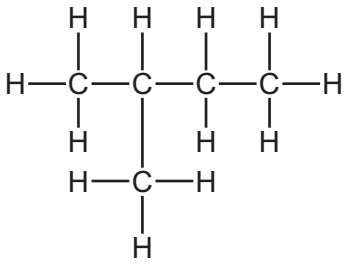

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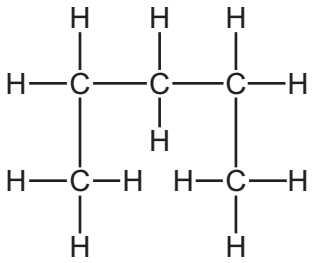

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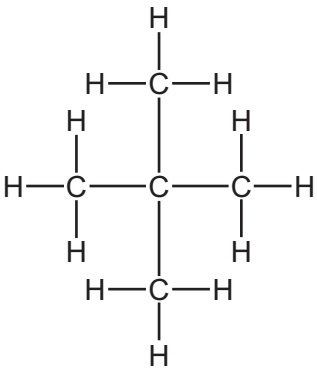


Which molecules are structural isomers of structure 1?

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

36 Which chemical equation for the substitution of an alkane with chlorine is correct?

A $C_3H_8 + Cl_2 \rightarrow C_3H_7Cl + HCl$

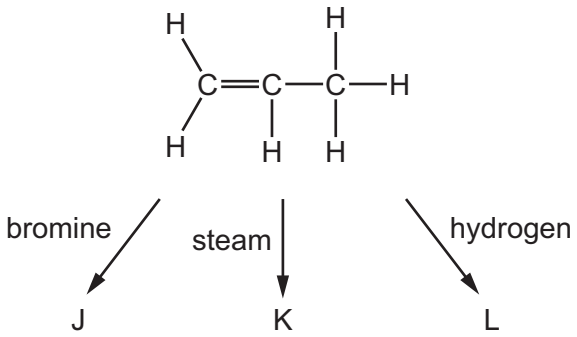
B $C_3H_6 + Cl_2 \rightarrow C_3H_6Cl_2$

C $C_3H_8 + Cl_2 \rightarrow C_3H_6Cl_2 + H_2$

D $C_3H_6 + Cl_2 \rightarrow C_3H_5Cl + HCl$

[Turn over

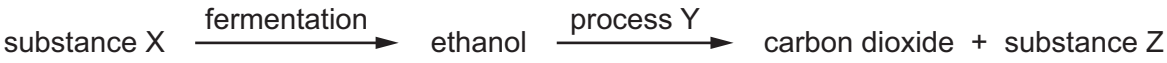
37 Propene is an alkene that reacts with bromine, steam and hydrogen as shown.



What are the products of these reactions?

	J	K	L
A	bromopropane	propanol	butane
B	dibromopropane	propanoic acid	propane
C	dibromopropane	propanol	propane
D	bromopropane	propanoic acid	butane

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 statements about aqueous ethanoic acid are correct?

1 It is an alkane.

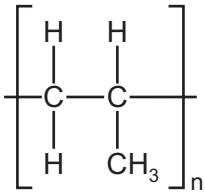
2 It reacts with sodium carbonate to form carbon dioxide.

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 The structure of a polymer is shown.



Which monomer forms this polymer?

A ethane

B ethene

C propane

D propene

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.).