



SINGAPORE CHINESE GIRLS' SCHOOL
Preliminary Examination
Secondary Four

CANDIDATE
NAME

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CLASS

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REGISTER
NUMBER

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CENTRE NUMBER

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INDEX NUMBER

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Chemistry

6092/01

Paper 1 Theory

Wednesday

31 August 2022

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction tape/fluid.

Write your name, class and index number on the Question Paper and Answer Sheet in the spaces provided.

There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A, B, C, 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.

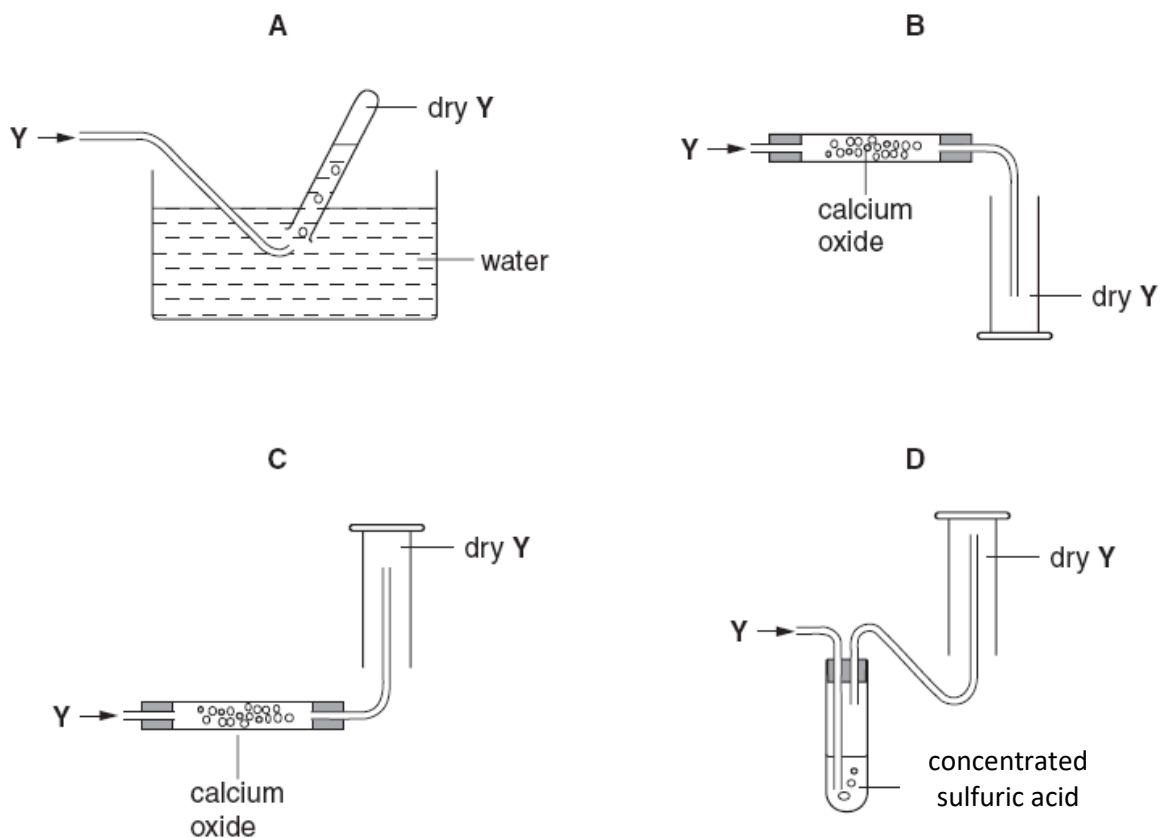
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 15.

The use of an approved scientific calculator is expected, where appropriate.

1. A gas **Y**, is less dense than air, very soluble in water and is alkaline.

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



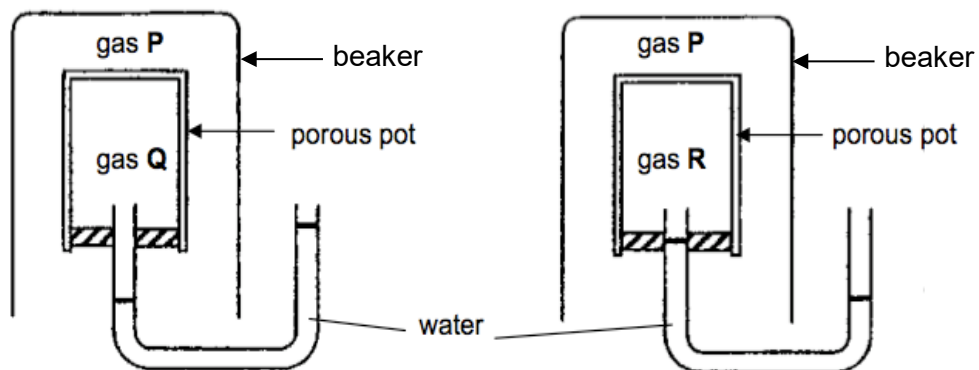
2. The following measurements are made on a sample pure water: its boiling point, its freezing point, and its pH.

Sodium chloride is now dissolved in the water and the measurements repeated.

How do the measurements change?

	boiling point	freezing point	pH
A	higher	lower	no change
B	higher	higher	increases
C	lower	higher	no change
D	lower	lower	decreases

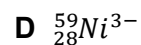
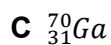
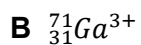
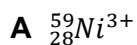
3. The apparatus can be used to show the diffusion of gases. Two beakers containing gas **P** were placed over two porous pots containing gases **Q** and **R** respectively. The results are shown below.



What is the correct order of the relative molecular mass of gases **P**, **Q** and **R**?

	Lowest M_r	→	Highest M_r
A	R	P	Q
B	R	Q	P
C	Q	P	R
D	P	Q	R

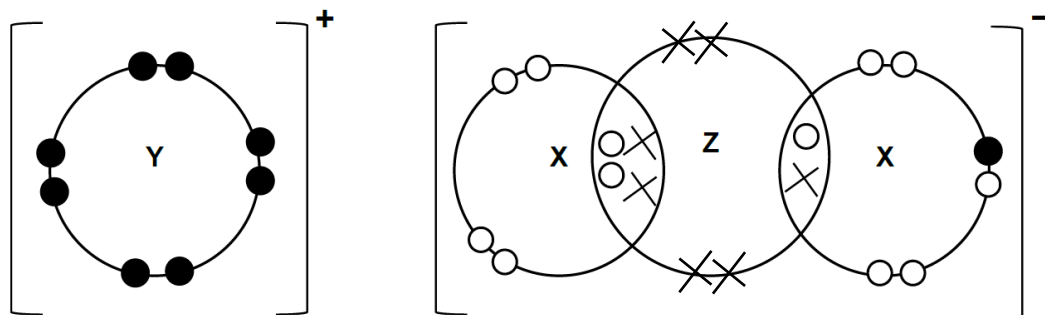
4. A particle contains 31 protons, 40 neutrons and 28 electrons. Which symbol is correct for this particle?



5. How many electrons in total are shared between the atoms in a molecule of ethene, C_2H_4 , and in a molecule of water, H_2O ?

	ethene	water
A	6	2
B	10	4
C	12	4
D	14	8

6. Which element forms a positive ion with the same electronic configuration as an atom of neon?
- A chlorine
B magnesium
C lithium
D oxygen
7. **X**, **Y** and **Z** are 3 different elements in the Periodic Table. The “dot and cross” diagram of the compound formed from **X**, **Y** and **Z** is shown below. Only the valence electrons are shown.



Which statements are correct?

- I Element **Y** could be lithium.
 II Element **X** belongs to Group VII of the Periodic Table.
 III Elements **X** and **Z** are bonded together by covalent bonds.
 IV There are more electrons than protons in ZX_2^- .

- A I and II only
 B III and IV only
 C I, III and IV only
 D II, III and IV only

8. Substance **X** has a high melting point. It is insoluble in water and organic solvents. It is used as a lubricant and is a conductor of electricity.

What is **X**?

- A** copper
- B** graphite
- C** potassium chloride
- D** hydrogen chloride

9. What is the ionic equation, including state symbols for the reaction between zinc carbonate and hydrochloric acid?

- A** $\text{ZnCO}_3(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
- B** $\text{CO}_3^{2-}(\text{aq}) + 2\text{H}^+(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
- C** $\text{Zn}_2\text{CO}_3(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow 2\text{Zn}^+(\text{s}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
- D** $\text{Zn}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}(\text{s}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$

10. Which quantity contains the least number of atoms?

- A** 0.6 moles of oxygen gas
- B** 0.75 moles of lithium
- C** 0.25 moles of ammonia
- D** 0.25 moles of methane

11. Brass is a mixture of copper and zinc. A sample of brass has a mass of 24.0 g. When reacted with excess dilute sulfuric acid, 1.85 dm³ of hydrogen was collected.

What is the percentage of copper in the sample of brass?

- A** 20.9%
- B** 41.8 %
- C** 58.2 %
- D** 79.1 %

12. In leaded petrol there is an additive composed of lead, carbon and hydrogen only. This compound contains 29.7 % carbon and 6.19 % hydrogen by mass.

What is the value of x in the empirical formula PbC_8H_x ?

- A** 5
- B** 6
- C** 16
- D** 20

13. How much sulfuric acid is required to neutralize 100 cm³ of 1.0 mol/dm³ sodium hydroxide?

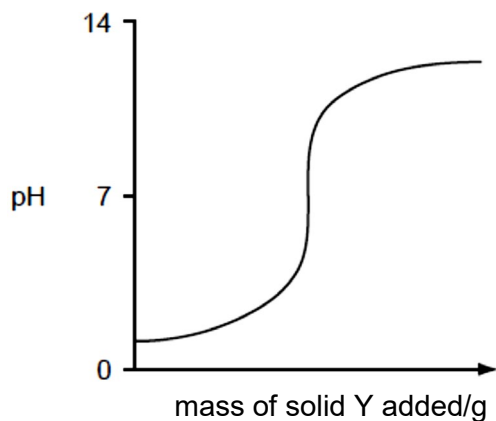
- A 50 cm³ of 0.5 mol/dm³ sulfuric acid
- B 100 cm³ of 1.0 mol/dm³ sulfuric acid
- C 50 cm³ of 1.0 mol/dm³ sulfuric acid
- D 100 cm³ of 2.0 mol/dm³ sulfuric acid

14. In an experiment, 1 cm³ of gaseous hydrocarbon **X** required 4 cm³ of oxygen for complete combustion to produce 3 cm³ of carbon dioxide. All gas volumes are measured at room temperature and pressure.

Which formula represents **X**?

- A C₂H₄ B C₃H₄ C C₃H₈ D C₄H₈

15. Solid **Y** was added bit by bit with stirring to an aqueous solution of **Z**. The changes in pH of the mixture are shown in the graph.



Identify **Y** and **Z**.

	Y	Z
A	soluble metal oxide	hydrochloric acid
B	soluble metal oxide	ethanoic acid
C	insoluble metal oxide	nitric acid
D	insoluble metal oxide	aqueous ammonia

16. A precipitate of lead(II) hydroxide dissolves in aqueous sodium hydroxide to form a colourless solution. Which property of lead(II) hydroxide can be deduced from the reaction?

A Lead(II) hydroxide is a reducing agent.
B Lead(II) hydroxide is basic.
C Lead(II) hydroxide is soluble in water.
D Lead(II) hydroxide is amphoteric.

17. The table below shows the properties of five salts, and how they can be prepared.

Which one is magnesium bromide?

	colour	solubility in water	methods to prepare salt
A	white	soluble	insoluble base and acid
B	brown	soluble	titration
C	white	insoluble	precipitation
D	brown	insoluble	metal and acid

18. Which is a property of the hydroxide ion?

A It combines with hydrogen to form water.
B It readily breaks down into hydrogen ions and oxide ions.
C It is formed when ammonia dissolves in water.
D It turns methyl orange red.

19. Which statements about sulfuric acid are correct?

I A blue precipitate is formed when copper(II) hydroxide is added.
II 1.0 mol of sulfuric acid contains 2.0 mol of hydrogen ions.
III Sulfuric acid turns Universal Indicator yellow.
IV Effervescence of a colourless gas is seen when calcium is added.

A I and III **B** II and III **C** I and IV **D** II and IV

20. Which substances would react with copper?

- I Dilute hydrochloric acid
- II Oxygen
- III Aqueous silver nitrate
- IV Cold water

- A I and II only
- B II and III only
- C III and IV only
- D All of the above

21. Which substance could be zinc?

	conducts electricity		state of product formed when heated with oxygen
	when solid	when liquid	
A	✓	✓	solid
B	x	✓	no reaction
C	✓	x	solid
D	x	x	gas

22. Metal **M** will displace iron from aqueous iron(II) sulfate solution but not calcium from calcium nitrate. **M** is extracted from its oxide by electrolysis. **M** reacts with water.

What could **M** be?

- A magnesium
- B zinc
- C sodium
- D aluminium

23. Magnesium, on the left of Period 3 of the Periodic Table, is more metallic than chlorine on the right of this Period. This is because magnesium has

- A fewer electrons.
- B fewer protons.
- C fewer full shells of electrons.
- D fewer outermost electrons.

24. Crystals of iodine are heated gently. Which option correctly describes the formula of the particles present, the colour of the vapour produced and the bonds broken in the process?

	formula of particles	colour of vapour	bonds broken
A	I ⁻	purple	covalent bonds between atoms
B	I ⁻	brown	covalent bonds between molecules
C	I ₂	purple	Van der Waal's forces between molecules
D	I ₂	brown	Van der Waal's forces between atoms

25. An element has all four of the properties shown.

- solid at room temperature
- variable oxidation states
- forms coloured compounds
- high conductivity

What could this element be?

- A** strontium
B zinc
C graphite
D cobalt

26. When ammonia is converted into nitric acid on a commercial scale, the following reactions can occur.

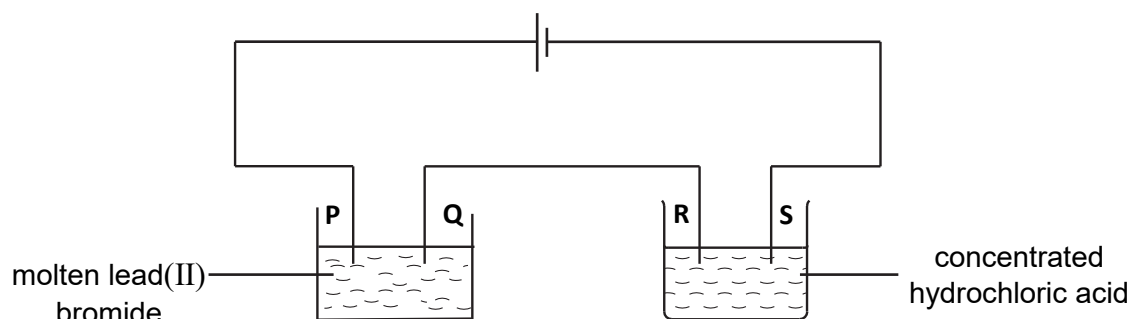
In which reaction does the greatest change in oxidation number of the nitrogen occur?

	reaction
A	$4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$
B	$3\text{NO}_2 + \text{H}_2\text{O} \rightarrow 2\text{HNO}_3 + \text{NO}$
C	$2\text{NO} + \text{O}_2 \rightarrow 2\text{NO}_2$
D	$4\text{NH}_3 + 6\text{NO} \rightarrow 5\text{N}_2 + 6\text{H}_2\text{O}$

27. In which reaction is sulfur dioxide acting as an oxidizing agent?

- A** $\text{SO}_2 + 2\text{H}_2\text{O} + \text{Cl}_2 \rightarrow \text{H}_2\text{SO}_4 + 2\text{HCl}$
B $\text{SO}_2 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_3 + \text{H}_2\text{O}$
C $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$
D $\text{SO}_2 + 2\text{H}_2\text{S} \rightarrow 2\text{H}_2\text{O} + 3\text{S}$

28. An electrolytic circuit is set up, using inert electrodes **P**, **Q**, **R** and **S**.



At which of the electrodes is a Group VII element produced?

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

29. A current is passed through each of the following electrolytes using inert electrodes. Which one will produce a neutral solution at the end of the electrolysis?

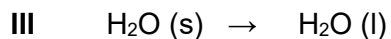
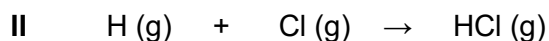
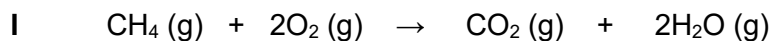
- A** Aqueous sodium sulfate
B Concentrated potassium chloride solution
C Dilute sulfuric acid
D Aqueous copper(II) nitrate solution

- 30.** The table shows the energy released by the complete combustion of some compounds used as fuels.

Which fuel produces the most energy when 1 g of the compound is completely burned?

	compound	M_r	ΔH in kJ/mol
A	methane	16	-880
B	ethanol	46	-1380
C	propane	44	-2200
D	heptane	100	-4800

- 31.** Which change(s) is/are exothermic?



- A** I only **B** I and II only **C** II and III only **D** I, II and III only

- 32.** The usual conditions of the Haber Process are 250 atm, 450°C and an iron catalyst.

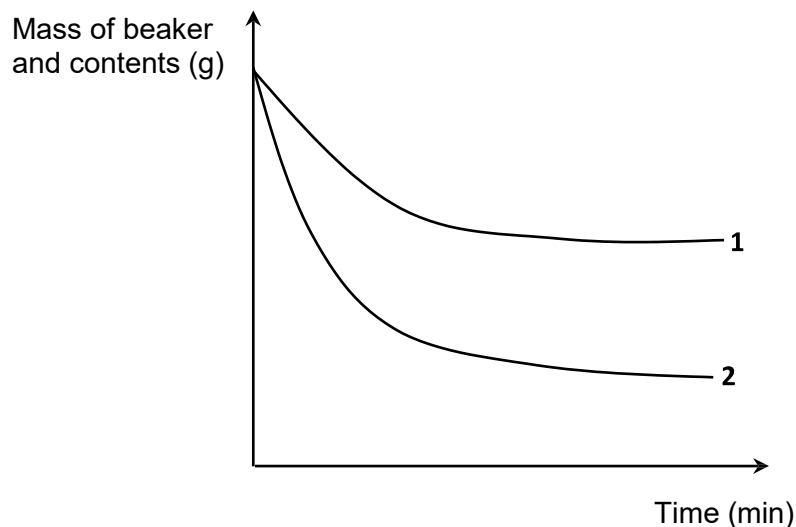
Which change in conditions will give the reactants more energy?

- A** Addition of more catalyst
B A decrease in pressure
C An increase in concentration of the reactants
D An increase in temperature

- 33.** Excess magnesium was added to a beaker of dilute hydrochloric acid on an electronic balance.

A graph of the mass of the beaker and contents was plotted against time (curve **1**).

What change(s) in the experiment could give curve **2**?



- I** The same mass of magnesium but in smaller pieces.
- II** The same volume of a more concentrated solution of hydrochloric acid.
- III** A lower temperature.

- A** I only.
- B** II only.
- C** I and II only.
- D** II and III only.

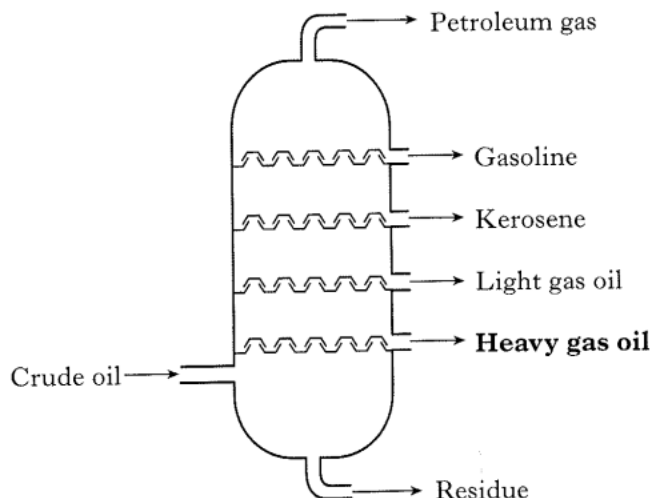
- 34** Mohr's salt is a pale green crystalline solid which is soluble in water. It is a 'double sulfate' which contains two cations, one of which is Fe^{2+} .

The identity of the second cation was determined by heating solid Mohr's salt with aqueous sodium hydroxide. The gas evolved turned moist red litmus blue. A grey-green solid residue was also formed.

What are the identities of the gas and the solid residue?

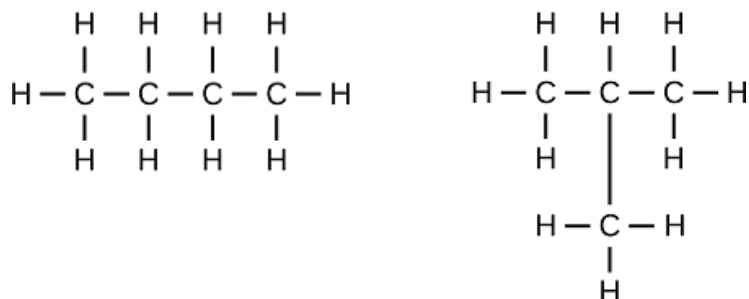
	gas	residue
A	H_2	$(\text{NH}_4)_2\text{SO}_4$
B	NH_3	FeSO_4
C	NH_3	$\text{Fe}(\text{OH})_2$
D	SO_2	$\text{Fe}(\text{OH})_2$

35. Heavy gas oil produced by fractional distillation of crude oil has a high viscosity. Which other properties does it also have?



- A Low boiling point and high flammability
B High boiling point and low flammability
C Low boiling point and low flammability
D High boiling point and high flammability
36. $C_{10}H_{22}$ was cracked into a shorter alkane with 6 carbon atoms and an alkene. What would be the molecular formula of the alkene?
- A C_6H_{14} B C_6H_{12} C C_4H_8 D C_4H_{10}
37. Under certain conditions, 1 mole of ethane reacts with chlorine.
Which is **not** a possible product of this reaction?
- A $C_2H_4Cl_2$ B $C_2H_2Cl_4$ C $C_2H_2Cl_2$ D C_2Cl_6

38. The diagram shows two compounds.



It can be predicted from their formulae that the compounds have the same

- A** composition by mass.
 - B** boiling point.
 - C** structural formula.
 - D** density
39. Which substance is formed when propan-1-ol, $\text{C}_3\text{H}_7\text{OH}$, is reacted with acidified potassium manganate(VII)?
- A** C_3H_8 **B** $\text{C}_3\text{H}_7\text{OK}$ **C** $\text{C}_3\text{H}_7\text{COOH}$ **D** $\text{C}_2\text{H}_5\text{COOH}$
40. With which substance will ethene react to form more than one product?
- A** bromine
 - B** steam
 - C** hydrogen
 - D** oxygen

Group																	
I	II		Key			1 H hydrogen 1	III	IV	V	VI	VII	0					
3 Li lithium 7	4 Be beryllium 9	proton (atomic) number atomic symbol name relative atomic mass															
11 Na sodium 23	12 Mg magnesium 24																
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 actinoids	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 -	117 Ts tennessine -	118 Og oganeson -	119 Nh nihonium -	120 Dl dubnium -

actinoids

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