YUYING SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary 4 Express

NAME			
CLASS		**REG. NO**	

CHEMISTRY 6092/1

Paper 1

26th August 2020

1 hour

Candidates answer on the Question Paper.
Additional Materials: Multiple Choice Answer Sheet

Setter: Mr Kelvin Goh

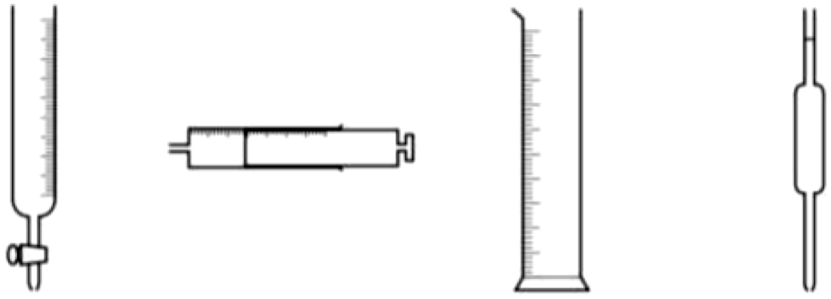
READ THESE INSTRUCTIONS FIRST
Write your name, class and register number on this question booklet.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

The use of an approved calculator is expected, where appropriate.
A copy of the Periodic Table is printed on page 17.

For Examiner's Use	
Total	**40**

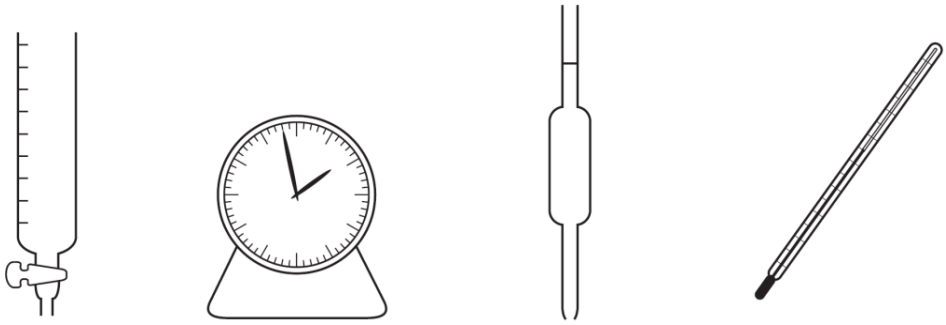
1 Four pieces of apparatus used to measure the volume of a gas or liquid are shown below. Which apparatus should always be filled to the same level?



A **B** **C** **D**

2 25 cm^3 samples of dilute hydrochloric acid were mixed with different volumes of aqueous sodium hydroxide. In each case, the change in temperature was measured to test if the reaction was exothermic.

Which piece of apparatus is **not** needed for the experiment?



A **B** **C** **D**

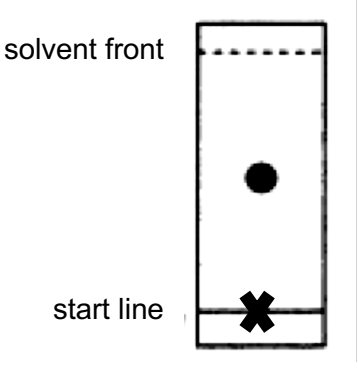
3 Camphor is a substance used in skin ointments and a natural sample of it is found to contain impurities such as iron, iron(III) oxide and sodium chloride.
The table shows the reactions of camphor and the impurities with some common laboratory solvents.

substance	ethanol	dilute nitric acid	water
camphor	soluble	no reaction	insoluble
iron	insoluble	orange solution	insoluble
iron(III) oxide	insoluble	orange solution	insoluble
sodium chloride	insoluble	colourless solution	soluble

Which is the best method to obtain a pure, dry sample of camphor?

A add dilute nitric acid, filter and crystallise
B add dilute nitric acid, filter, rinse and dry
C add ethanol, filter, rinse and dry
D add water, filter, add nitric acid to filtrate and crystallise

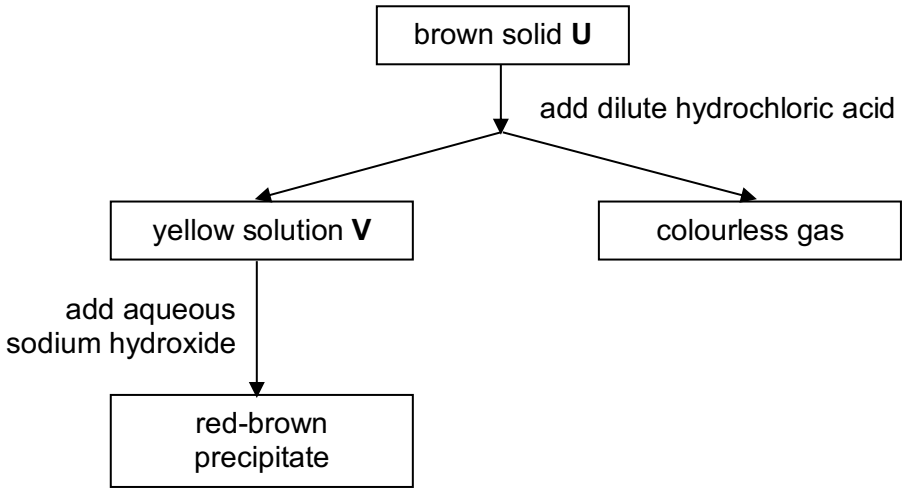
4 Chromatography was carried out on a drug that was banned for use by athletes. Water was used as a solvent and the results are shown in the chromatogram below.



Which statement below best describes the chromatogram?

A The drug has a Rf value of 0.82.
B The drug is insoluble in the solvent.
C The drug is a mixture.
D The start line is drawn using a substance which is insoluble in water.

5 The flowchart shows the results of some tests carried out on a brown solid **U**.



Which of the following observations are obtained when an excess of zinc is added to yellow solution **V**?

I Effervescence is seen.
II A green solid is formed.
III Zinc metal decreases in size.
IV The yellow solution turns colourless.

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

6 When dilute nitric acid and aqueous barium nitrate were added to solution **F**, a white precipitate was observed.

When aqueous sodium hydroxide was added to solution **F**, a white precipitate which was soluble in excess aqueous sodium hydroxide to form a colourless solution was observed.

What is the identity of solution **F**?

A aluminium sulfate
B calcium sulfate
C silver nitrate
D zinc chloride

7 A sample of oxygen contains two isotopes: oxygen-16 and oxygen-18. The relative abundance of oxygen-16 is 75% and that of oxygen-18 is 25%.

What is the relative molecular mass of the sample of oxygen gas, O_2?

A 16.5
B 17.0
C 33.0
D 34.0

8 An atom of element **T** has **x** protons and **y** nucleons.
How many neutrons and electrons are present in a **positive ion** of an isotope of element **T**?

	neutrons	**electrons**
A	y	x – 1
B	y – x	x + 1
C	y – x + 2	x – 1
D	y – x + 2	x

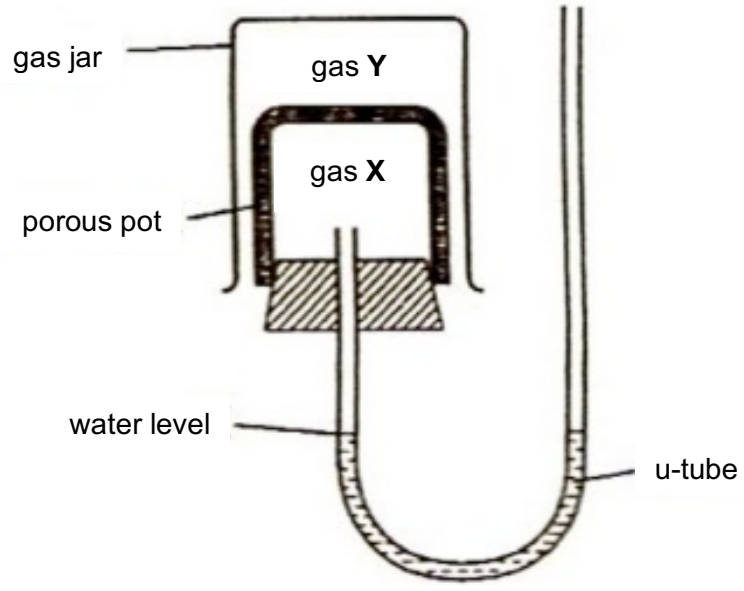
9 The melting and boiling points of substances **P**, **Q**, **R**, **S** and **T** are shown in the table.

substance	**melting point (°C)**	**boiling point (°C)**
P	50	80
Q	70	500
R	65	67
S	-30	-12
T	0	99

At which temperature would two liquids exist?

A -40 °C
B -20 °C
C 15 °C
D 85 °C

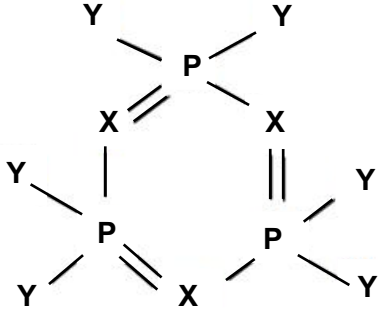
10 Gas **X** was placed in a porous pot and covered by a gas jar containing gas **Y**, as shown in the experimental setup below.



There were no changes observed in the water levels in the U-tube.
Which of the following could be gas **X** and gas **Y**?

	gas **X**	gas **Y**
A	nitrogen monoxide	carbon dioxide
B	nitrogen dioxide	sulfur dioxide
C	carbon monoxide	nitrogen
D	sulfur dioxide	ammonia

11 A molecule consists of three elements, **P**, **X** and **Y**.



If **P** is phosphorus, what could elements **X** and **Y** be?

	X	**Y**
A	iron	nitrogen
B	nitrogen	hydrogen
C	oxygen	nitrogen
D	silicon	chlorine

12 What are the type(s) of chemical bond(s) present in a molecule of sodium ethanoate, $NaCH_3COOH$?

A covalent only.
B covalent and ionic.
C ionic only.
D ionic and metallic.

13 Some physical properties of substances, **R**, **S** and **T** are shown in the table below.

substance	melting point (°C)	boiling point (°C)	electrical conductivity	
			solid state	molten state
R	-115	75	poor	poor
S	2852	3600	poor	good
T	3550	4827	good	good

What are the identities of substances **R**, **S** and **T**?

	R	S	T
A	ethanol	magnesium oxide	graphite
B	magnesium oxide	iron	diamond
C	magnesium oxide	iron	graphite
D	ethanol	magnesium oxide	diamond

14 Which of the following observations best suggests that an unknown solid **X** is an element?

A X displays magnetic properties.
B X forms oxides with two different chemical formulas when heated in air.
C X gives off a colourless gas and leaves behind a black solid when heated.
D X melts at 11 °C and boils at 122 °C.

15 Which of the following best describes the particles present in a diluted solution of potassium chloride?

	potassium chloride ions	water molecules
A	far apart	close together
B	close together	close together
C	close together	far apart
D	far apart	far apart

16 Some aqueous silver nitrate was added to an excess of aqueous sodium chloride in a beaker. Apart from silver chloride, what does the resulting solution in the beaker after the reaction contain?

A aqueous silver nitrate and aqueous sodium nitrate
B aqueous sodium chloride and aqueous sodium nitrate
C aqueous sodium chloride only
D aqueous sodium nitrate only

17 The chemical formula of hydrated copper(II) nitrate is $Cu(NO_3)_2.6H_2O$. What is the percentage by mass of water in hydrated copper(II) nitrate?

A 6.1%
B 9.6%
C 36.5%
D 57.4%

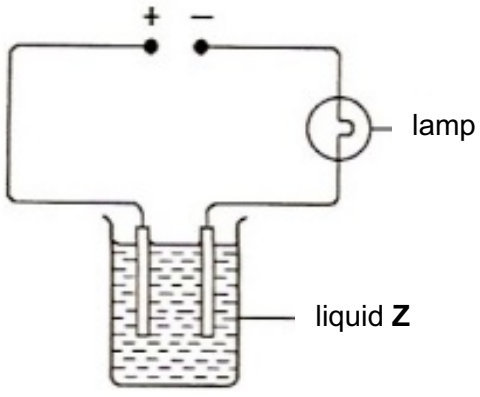
18 Antimony oxide has a chemical formula of Sb_2O_3 while sodium phosphate has a chemical formula Na_3PO_4. What is the formula of antimony phosphate?

A $SbPO_4$
B Sb_2PO_4
C Sb_3PO_4
D $Sb_2(PO_4)_3$

19 When molten magnesium bromide undergoes electrolysis using platinum electrodes, what are the products collected at the electrodes?

	anode	**cathode**
A	oxygen	hydrogen
B	bromine	magnesium
C	magnesium	bromine
D	hydrogen	bromine

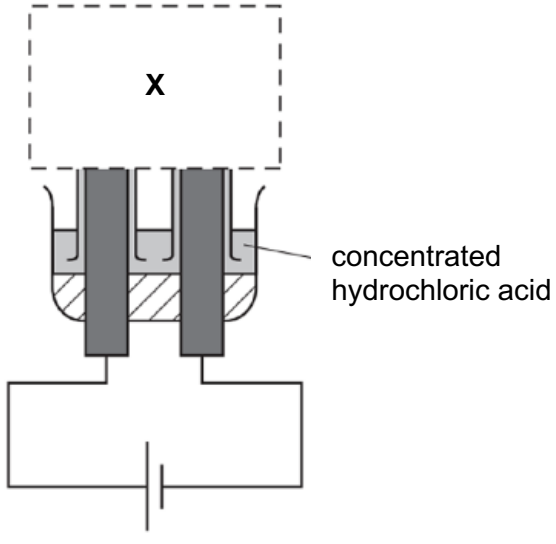
20 The following set-up was used to conduct an electrolysis experiment. Liquid **Z** was used as the electrolyte.



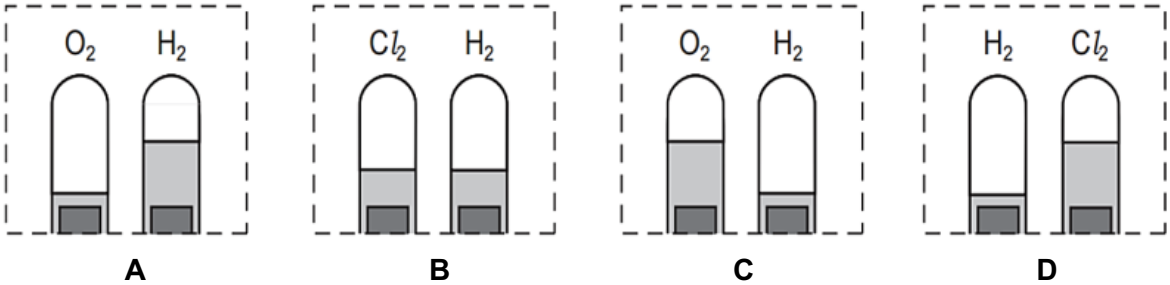
Initially, the lamp lit up brightly. However, when a few drops of dilute sulfuric acid were added to liquid **Z**, the lamp decreased in brightness. What could liquid **Z** be?

A aqueous calcium hydroxide
B aqueous sodium hydroxide
C aqueous sodium chloride
D dilute nitric acid

21 The electrolysis set-up shown below is not complete.

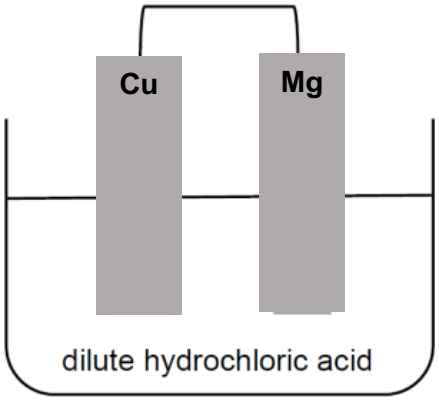


Which diagram should be shown at **X** when the solution has undergone electrolysis for a few minutes?



A **B** **C** **D**

22 A piece of copper was joined to a piece of magnesium by a wire in the set-up shown below.



Which of the following ionic half equations best describes the reaction at the negative terminal?

A $Cu \rightarrow Cu^{2+} + 2e^-$
B $Mg \rightarrow Mg^{2+} + 2e^-$
C $2H^+ + 2e^- \rightarrow H_2$
D $4OH^- \rightarrow 2H_2O + O_2 + 4e^-$

23 The equation below shows an endothermic reaction.

$$2\ X{-}X + Y{-}Y \rightarrow 2\ X{-}Y{-}X$$

What may be deduced from the information provided?

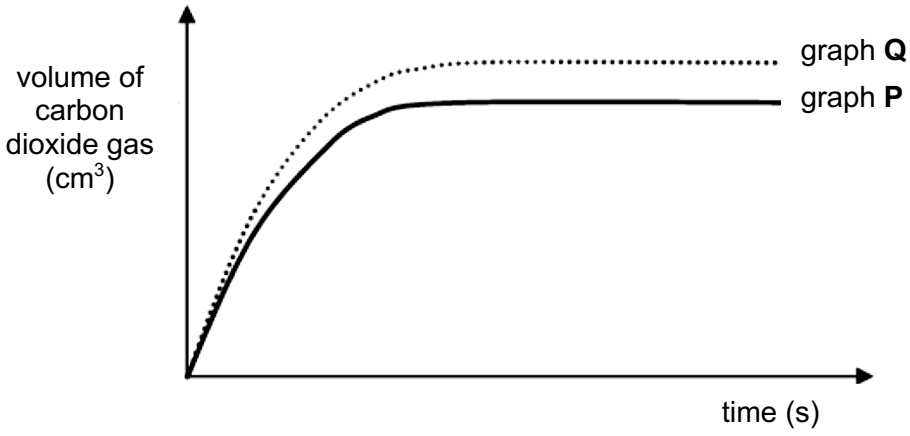
A The number of bonds broken is greater than the number of bonds formed.
B The formation of the X-Y bond absorbed heat.
C The total energy change in bond breaking is greater than that in bond forming.
D The energy level of the product is lower than the energy level of the reactants.

24 Which of the following chemical reactions are endothermic?

I	$6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$
II	$MgF_2 \rightarrow Mg + F_2$
III	$CuCO_3 \rightarrow CuO + CO_2$
IV	$KOH + HCl \rightarrow KCl + H_2O$

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

25 In an experiment, an excess of 2 mol/dm^3 dilute hydrochloric acid was reacted with 50 cm^3 of 1 mol/dm^3 aqueous potassium carbonate. The results of the experiment are shown in graph **P** below.



Which of the following changes to graph **P** would produce graph **Q**?

A adding a catalyst to the reaction mixture
B adding a small amount of solid potassium carbonate to the reaction mixture
C adding water to the reaction mixture
D increasing the concentration of hydrochloric acid

26 The following statements are used to describe the chemical reaction shown below.

$$2\,X\,(s) + Y_2\,(aq) \rightarrow 2\,XY\,(g)$$

I	All collision between particles of X and Y_2 produce XY.
II	The frequency of collisions is affected by an increase in pressure on the reactant particles.
III	The frequency of collisions is increased by an increased in the temperature of the reaction mixture.
IV	The frequency of collisions is increased by an increase in the concentration of Y_2.

Which statements are correct?

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

27 Which compound(s) in the following chemical reactions has/have been oxidised?

$CuCO_3 \rightarrow CuO + CO_2$
$CuO + SnO \rightarrow Cu + SnO_2$

A CO_2 and CuO
B $CuCO_3$ and SnO
C CuO
D SnO

28 Which of the following equations does **not** represent a redox reaction?

A $Ag^+ (aq) + Cl^- (aq) \rightarrow AgCl (s)$
B $Ca (s) + 2 HCl (aq) \rightarrow CaCl_2 (aq) + H_2 (g)$
C $Sn^{2+} (aq) + 2 Fe^{3+} (aq) \rightarrow Sn^{4+} (aq) + 2 Fe^{2+} (aq)$
D $Zn (s) + 2 H^+ (aq) \rightarrow Zn^{2+} (aq) + H_2 (g)$

29 Which of the following pairs of elements forms amphoteric oxides?

A carbon and sulfur
B hydrogen and sulfur
C potassium and zinc
D zinc and aluminium

30 Which of the following substances are arranged in increasing pH?

A limewater, aqueous sodium hydroxide, vinegar, dilute sulfuric acid
B dilute sulfuric acid, vinegar, limewater, aqueous sodium hydroxide
C dilute sulfuric acid, vinegar, aqueous sodium hydroxide, limewater
D vinegar, dilute sulfuric acid, aqueous sodium hydroxide, limewater

31 Which of the following salts gives only a low yield when it is made by reacting a metal oxide with dilute sulfuric acid?

A barium sulfate
B copper(II) sulfate
C iron(II) sulfate
D zinc sulfate

32 The table shows the properties of four chlorides.
Which of the following most likely represents copper(II) chloride?

chloride	colour	solubility in water	method of preparation
A	green	soluble	copper(II) oxide, hydrochloric acid
B	green	insoluble	copper metal, hydrochloric acid
C	white	insoluble	sodium chloride, copper(II) sulfate
D	green	soluble	copper metal, hydrochloric acid

33 In the Haber process, how is the ammonia formed removed from the reaction mixture?

A adding water to dissolve ammonia
B cooling the reaction mixture to liquefy ammonia
C filtering the reaction mixture to remove ammonia
D fractional distilling of the reaction mixture to extract ammonia

34 Many agricultural fertilizers are made from ammonia. Ammonium compounds supply plants with nitrogen for protein synthesis. An example of such a fertilizer is ammonium nitrate that can be produced using the following reaction scheme:

ammonia $\xrightarrow{\textbf{step 1}}$ aqueous ammonia $\xrightarrow{\textbf{step 2}}$ ammonium nitrate

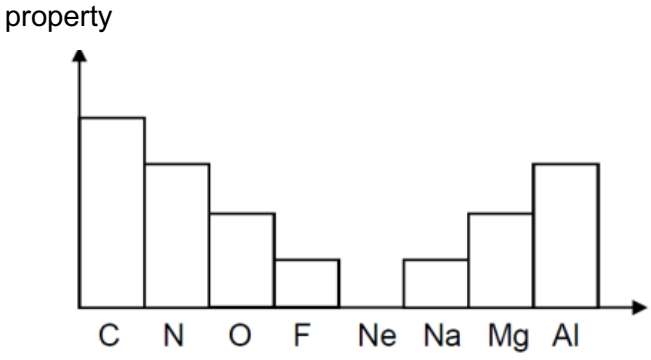
What are the reactants that can be used to carry out **steps 1** & **2**?

	step 1	step 2
A	sodium hydroxide	nitric acid
B	water	sodium nitrate
C	water	nitric acid
D	sodium hydroxide	sodium nitrate

35 Astatine is a halogen. Which statement about astatine is **not** correct?

A It exists as a diatomic molecule.
B It forms a soluble silver salt.
C It is a dark solid at room temperature.
D It is less reactive than iodine.

36 A property of the elements from carbon to aluminium is shown on the graph below.
Which property is shown on the chart?



A the atomic (proton) number
B the number of electrons involved in bonding
C the number of electrons shells filled with electrons
D the relative atomic mass

37 Three unknown metals **E**, **F** and **G** were place into different aqueous nitrate solutions. The subsequent observations were recorded in the table below.

	E	**F**	**G**
metal E nitrate solution	no change observed	no change observed	no change observed
metal F nitrate solution	a metallic deposit was observed	no change observed	no change observed
metal G nitrate solution	a metallic deposit was observed	a metallic deposit was observed	no change observed

What are the identities of the three metals?

	E	**F**	**G**
A	zinc	magnesium	aluminium
B	magnesium	zinc	calcium
C	silver	zinc	magnesium
D	magnesium	zinc	silver

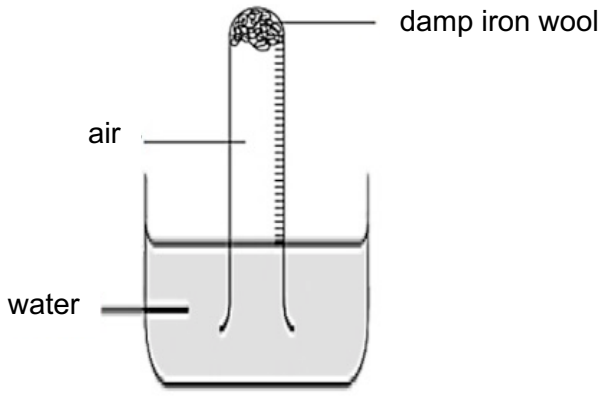
38 Which substance below is made from mild steel?

A a car body
B a container to store gas in a chemical plant
C a small cutting tool for use in an operating theatre
D a set of cutlery

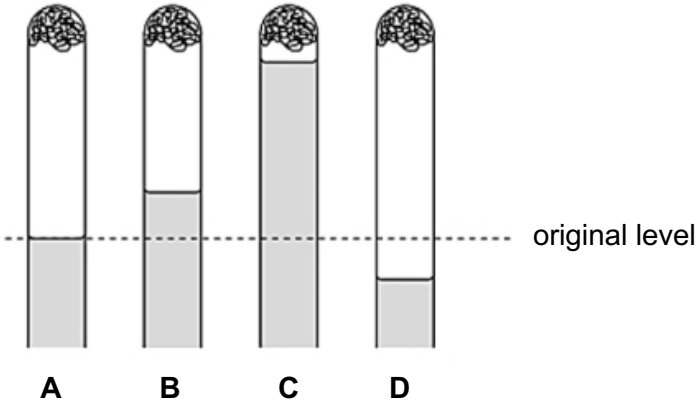
39 Which of the following pollutants are present in flue gases?

A carbon dioxide
B methane
C ozone
D sulfur dioxide

40 The apparatus shown is set up and left to stand for a week.



Where would the water level be at the end of the week?



END OF PAPER

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** proton (atomic) number atomic symbol name relative atomic mass									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 –		

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.).